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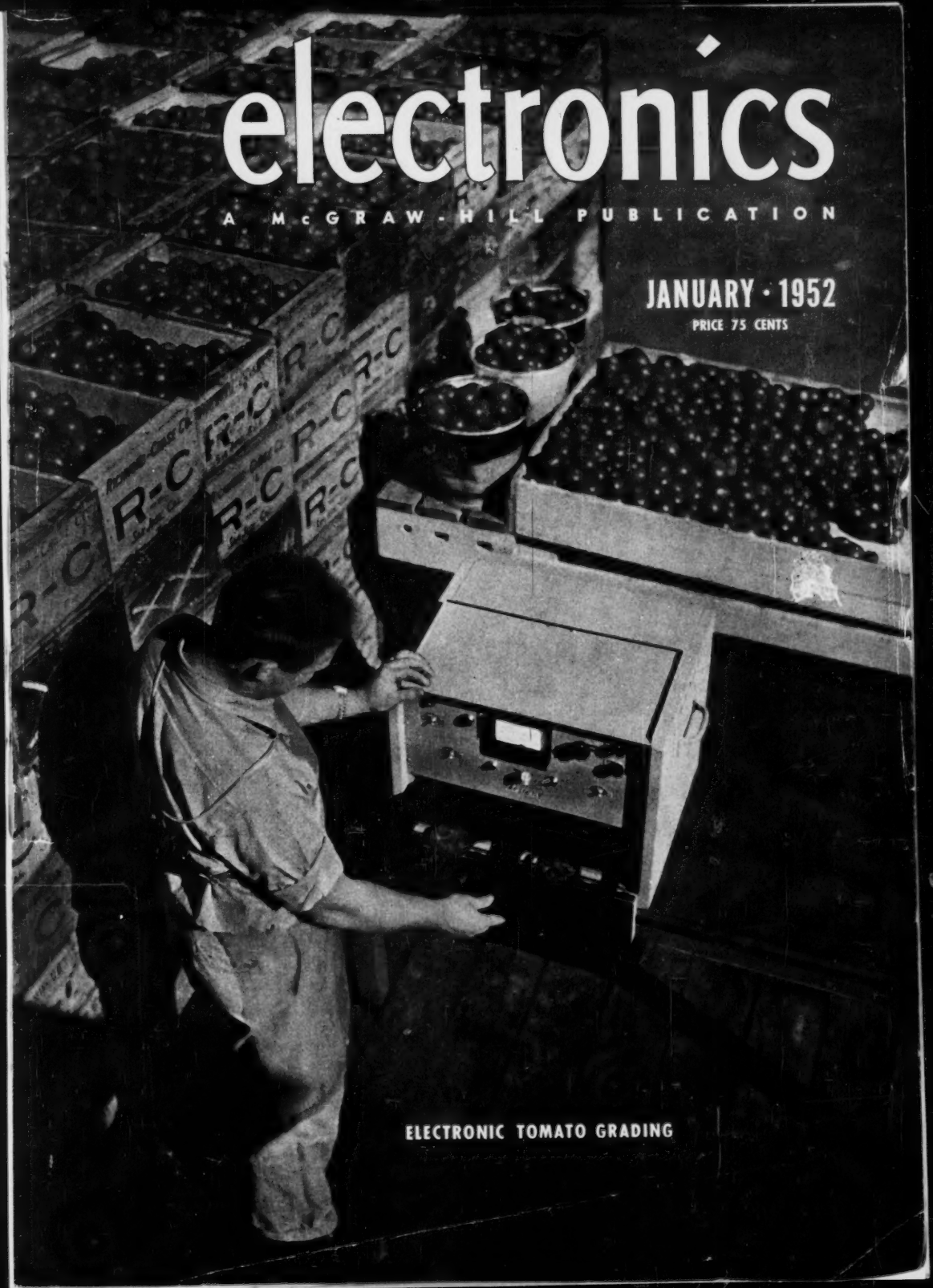
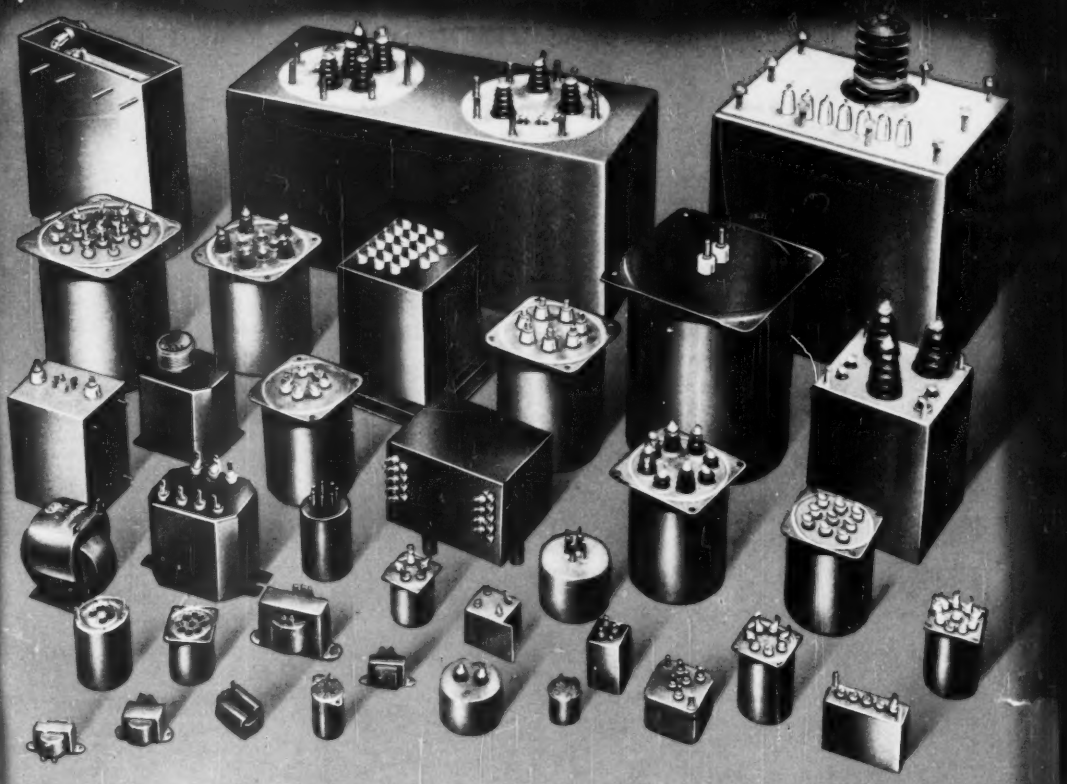


ELECTRONIC TOMATO GRADING

UTC for MILITARY COMPONENTS



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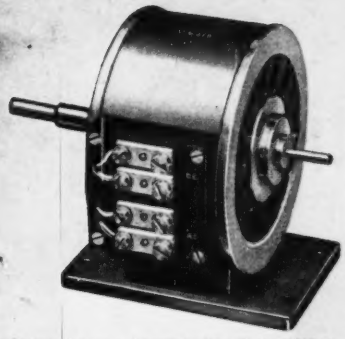
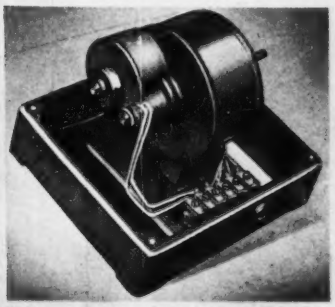
Phonic Motors and Timing Devices

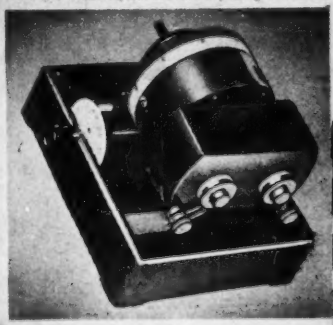


Designed for use at frequencies from 50 c/s - 2000 c/s. Phonic Motors of this type form the nucleus around which are built the timing devices illustrated on this page.



The Timing Device Type D-199-A provides an impulse of 1/10 second duration once every second, when the motor is supplied with power at a frequency of 1000 c/s.

The Timing Device Type D-193-A provides an impulse of 1/10 second duration 61 times per minute and, in addition, an impulse of ½ second duration once per minute. A worm and wheel adjustment allows phasing correction.



IN many branches of scientific work the need arises for a motor capable of a very high standard of constancy of speed. The frequency of the mains electricity supply is not normally controlled to better than one or two per cent., so that a mains-operated synchronous motor may be inadequate, and centrifugal governors, as used on gramophone motors, may not provide a sufficiently precise control. In such cases a phonic motor driven by an alternating current supply of high frequency stability may be employed. It is not perhaps generally realized that in their modern form such motors may be used to give quite a large torque, and are able to maintain synchronism despite the sudden imposition of relatively large inertia loads. Under steady-state conditions, "hunting" is almost entirely eliminated, and the constancy of rotational speed is almost entirely dependent on the frequency stability of the alternating current supply.

A precision quartz crystal controlled frequency of 100 kc/s may attain a frequency stability of the order of one part in 10^9. This frequency is then divided electronically to 1,000 c/s by means of regenerative dividers or locked multivibrators. In order to facilitate comparisons with time signals, or to use the frequency standard as a clock, it is necessary to derive a still lower frequency—preferably one cycle per second. Electronic division in the range 1,000 to 1 cycle per second, with high phase stability, is difficult, and the simplest and most reliable method is to drive a phonic motor from the 1,000 c/s source, and to fit mechanical contacts to suitably geared driven shafts. An added advantage is that by employing further gearing, more widely spaced signals may be obtained. Thus signals spaced at intervals of one sidereal second, or any other specified interval, may be obtained from an oscillator with a fundamental frequency of 100 kilocycles per mean time second. By means of a simple mechanical device, controlled changes in phase of the timing of the contacts are also possible.

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Specially designed to reduce thermal potentials and stray pickup, the new Brown *40X* servo amplifier incorporates an extra stage of amplification to provide increased sensitivity . . . permitting motor drive from signals as low as 0.05 microvolts.

Pictured with the amplifier is the rectifier which provides d-c filament voltage for the first amplifier tubes. It can be used as the basic link in a closed servo loop (where great sensitivity is required) . . . to translate electrical signals into directional motion . . . to provide corrective action in conjunction with minute error signals . . . for null detection . . . or for remote positioning.

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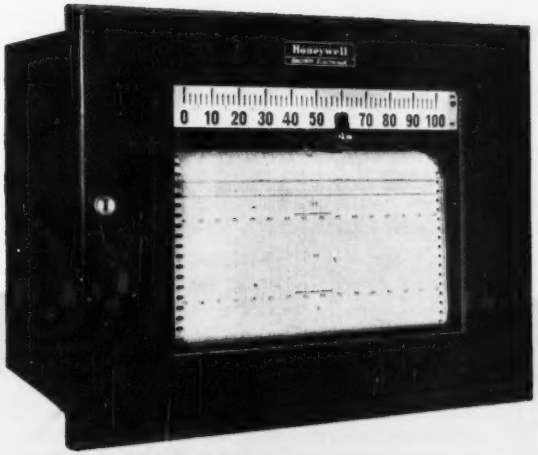
- EQUIPMENT INPUT IMPEDANCE—3000 ohms.
- STABILITY—(after warmup) —within 1.0 μv.
- DEAD ZONE (with 76750-3 motor)—0.1 μv.
- OVERALL VOLTAGE GAIN —40 x 10^6.
- 60 CYCLE OUTPUT CURRENT—0-12 MA.
- 60 CYCLE OUTPUT VOLTAGE—0-154.

Narrow Span Potentiometer



Self-contained *ElectroniK* narrow span potentiometer, incorporating new (*40X*) amplifier, *is ideal for measuring low level potentials.*

Electrical Characteristics

- RANGES—Recorders: 0-100 0-200, 0-500 microvolts, 0-1 millivolts. Indicators: 0-500 microvolts and 0-1.1 millivolts.
- STABILITY (after warmup)—1 microvolt or less for all ranges.
- LIMIT OF ERROR—½% of span.
- SENSITIVITY—0.1 microvolt.
- DEAD ZONE—0.1 microvolt or 0.006% of span (whichever is greater).
- PEN SPEEDS—24 or 12 seconds full travel.
- CONTROL FORMS—Any standard pneumatic form, circular chart only.
- CHART SPEEDS—Any standard speed.
- POWER SUPPLY—115 volts, 60 cycles only.
- RANGE OF INPUT SIGNALS TO RECORDER—(approx.) 0.05 μv. to 1 mv.

● *Important Reference Data*

Send for Data Sheet No. 10.20-4 on the (40X) Amplifier . . . Data Sheet No. 10.0-8 on the *ElectroniK* Narrow Span Potentiometer . . . and Bulletin No. 13-14, "Instruments Accelerate Research."

Now, with the development of a new high gain amplifier and potentiometer circuit, extremely low level potentials can be measured, recorded and controlled in this new self-contained instrument. The sensitivity of this instrument is so high that a change in signal as low as one-tenth of a microvolt can be determined. Spans as narrow as 100 microvolts provide a high degree of resolution. Internal design practically eliminates thermal emf's and stray a-c pickups.

The new *ElectroniK* Narrow Span Potentiometer may be used wherever the accurate measurement of d-c potentials of the order of microvolts is required . . . it is available as a Strip Chart Recorder (illustrated), as a Multi-Point Precision Indicator, and as a Circular Chart Recorder with pneumatic control.

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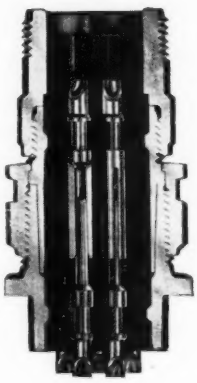

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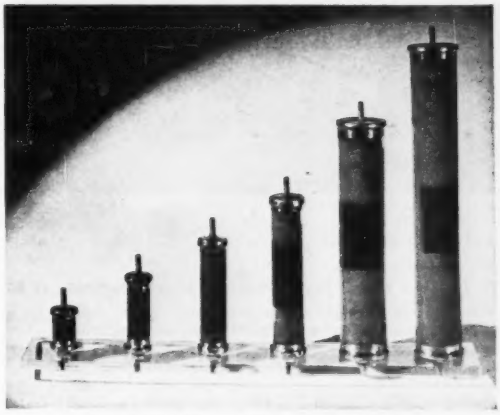

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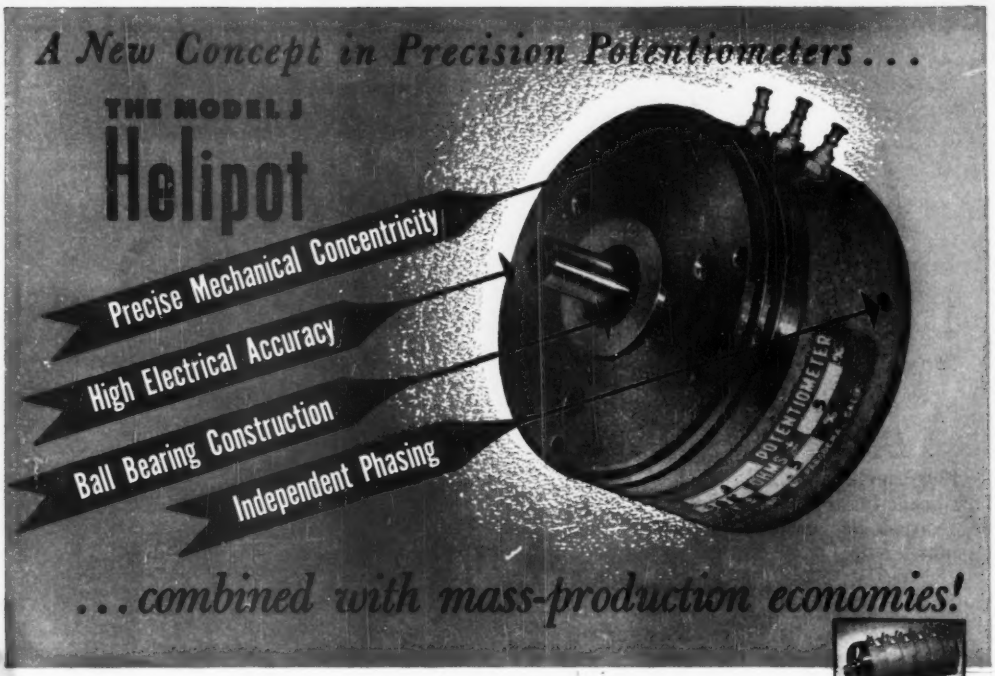

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In the "Model J," close concentricity between mounting surface and shaft is assured by a unique mounting arrangement. The unit can be aligned on either of two wide-base flange registers and secured with three screws from the front of the panel . . . or it can be secured with adjustable clamps from the rear of the panel to permit angular phasing. Or if preferred, it can be equipped with the conventional single-hole bushing type of mounting.

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The shaft of each "Model J" is carefully mounted on precision-type ball bearings that not only assure sustained rotational accuracy, but also provide the constant low-torque operation so essential for servo and computer applications. Starting torque is only ¾ of an inch-ounce (±.25 in.-oz.)—running torque, of course, is even less.

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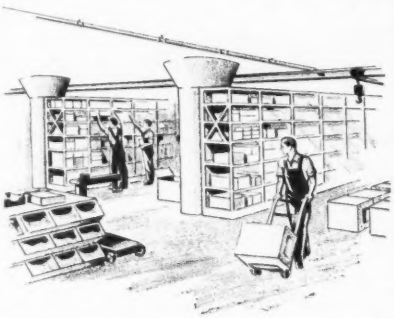


A distributor serves not only the factories from which he buys. He also performs an invaluable service to his customers by making quickly available to them the products they require. A machine shop, for example, may need only a few hundred pounds of brass rod; there is a distributor within easy reach who can furnish it almost immediately. Or a contractor may want a few pieces of steel pipe and a thousand feet or so of copper water tube. Again, the distributor has them. A metal products distributor has to carry such items and an infinite number of others. The Revere Distributor who started in business 125 years ago actually has in stock 53,000 different items, cataloged, indexed, and held in warehouses ready for immediate shipment throughout its territory. Each month this stock is drawn upon by 5,000 to 8,000 customers, each order relatively small. There are many Revere Distributors with similar stocks and offering equal service.

To keep this distributor's warehouses filled with a balanced inventory, 18 people are required in his purchasing staff, which includes specialists in various kinds of materials, machines, tools and supplies. And to serve customers with information, quotations and the like, 25 salesmen are on the go constantly, calling on manufacturers, contractors, builders and stores throughout the busy industrial area in which the distributor operates. The large business done by the company is in great contrast to that of 125 years ago, when it was little more than a hardware store. The enterprise has grown in the American tradition of freedom to prosper in accordance with the principles of reliability and efficiency, fair dealing and integrity in performing a desired function.

Revere Distributors are selected for their ability to serve, and also chosen as to location, so that no matter where you are in this big country of ours, there is a Revere Distributor within easy reach. Today metal stocks may be short due to defense demands but manufacturers are doing everything possible to keep distributors supplied.

If you buy from distributors we suggest you remember that they are not only "central stockrooms," but have a great deal of special knowledge about the products they sell and can give you much helpful advice. Not only that, through the Revere Distributors you can be put in touch with the Revere Technical Advisory Service, which will cooperate with you on matters concerning the selection and fabrication of the Revere Metals. Our distributors, and those of every other manufacturer, render many essential services, both to those to whom they sell, and to those from whom they buy. The distributor system as it operates in the United States arose in response to the need for it. Today it fulfills that need more effectively than ever before.

REVERE COPPER AND BRASS INCORPORATED

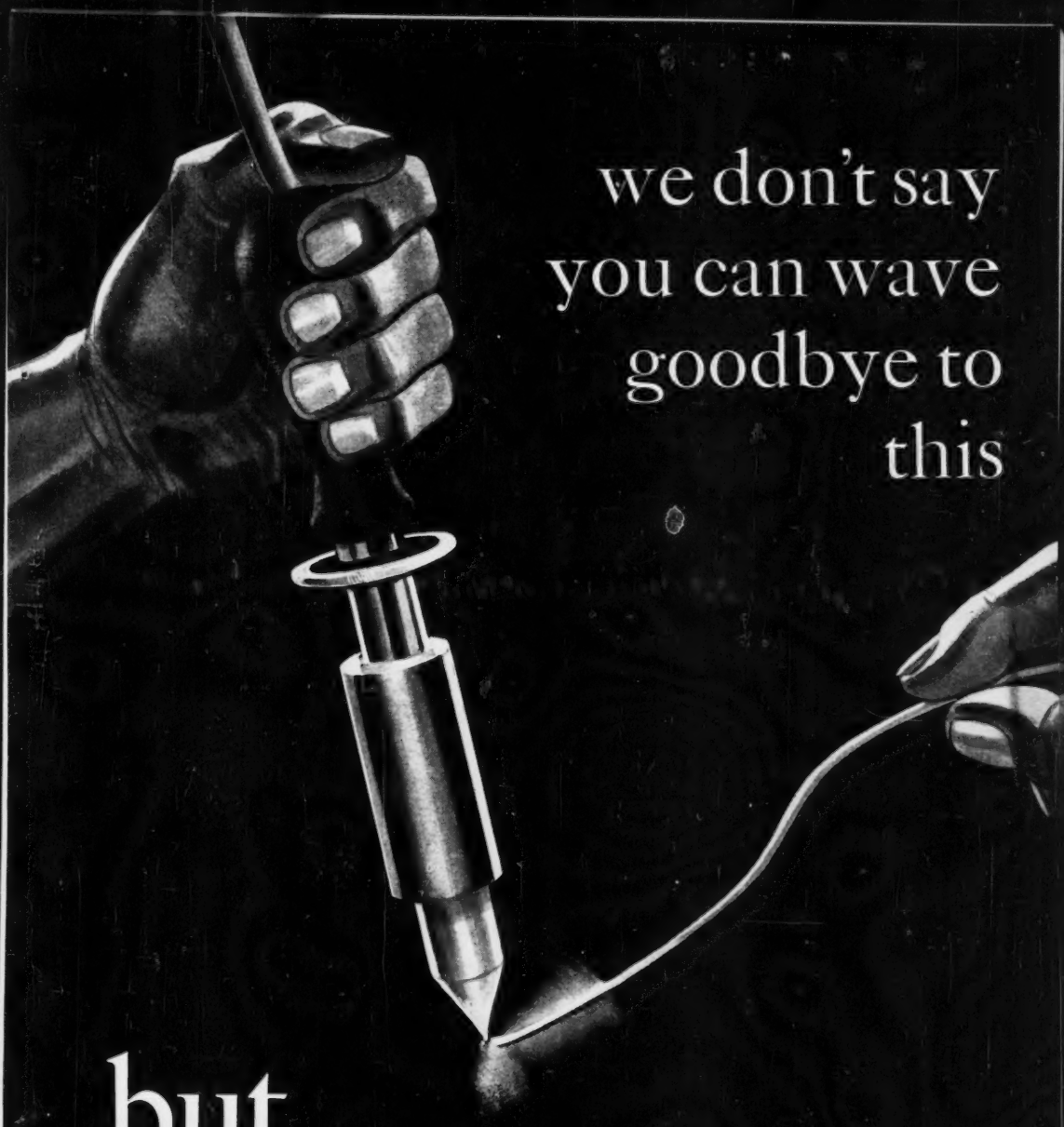
Founded by Paul Revere in 1801

150th YEAR OF SERVICE TO AMERICA

Executive Offices:

230 Park Avenue, New York 17, N. Y.

SEE "MEET THE PRESS" ON NBC TELEVISION EVERY SUNDAY



we don't say
you can wave
goodbye to
this

but

we can show you how to use it

less and less and less and less

For more information on how Centralab Printed Electronic Circuits can offer you big savings . . . See Next Two Pages.

Here's Proof: Printed Electronic

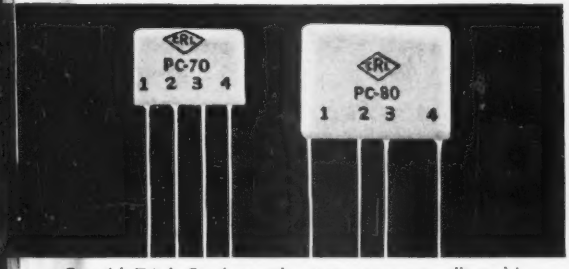
What are Printed Electronic Circuits?

Printed Electronic Circuits are complete or partial circuits (including all integral circuit connections) consisting of pure metallic silver and resistance materials fired to CRL's famous Steatite or Ceramic-X and brought out to convenient, permanently anchored external leads. They provide compact miniature units of widely diversified circuits — from single resistor plates to complete speech amplifiers. No other modern electronic development offers such tremendous time and cost saving advantages in low-power applications. ***Important to note:*** All PEC's illustrated are developed for standard applications. Numerous other circuit complements can be furnished for volume requirements.

How Do They Save Time and Money — Space and Weight?

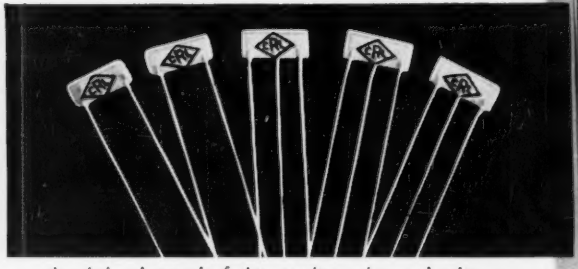
Because Printed Electronic Circuits combine several components on a single plate unit, they eliminate approximately 25% to 80% of formerly required soldered connections within the circuits they replace. This means simplified assembly — savings in material. What's more, because they replace several individual components, they cut down your purchases and inventory. Because they are complete assembled circuits, they do much to eliminate wiring errors. Their small size (note illustrations) means less space needed as well as less weight . . . important factors in today's crowded chasses.

60% Less Soldered Connections with Centralab Triode Couplates



Centralab Triode Couplates replace 5 components normally used in audio circuits. Triode Couplates are complete assemblies of 3 capacitors and 2 resistors bonded to a dielectric ceramic plate. Available in a variety of resistor and capacitor values. Technical Bulletin 42-127.

Plate Capacitor and Resistor-Capacitors Excellent for Miniature Use

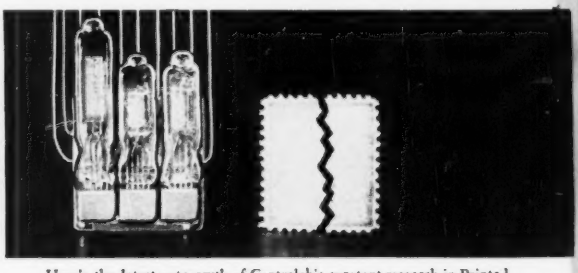


Actual size photograph of plate capacitor, resistor, and resistor-capacitor units. Because of size, they readily fit all types of miniature and portable electronic equipment . . . overcome crowded conditions in TV, AM, FM and record-player chassis. Technical Bulletin 42-24.

50% Less Soldered Connections with Centralab's AUDET

Audet Printed Electronic Circuits furnish all values of all components generally found in the output stage of AC-DC radio receivers. They provide 4 capacitors and 3 resistors on a small plate with only 7 leads. Technical Bulletin 42-129.

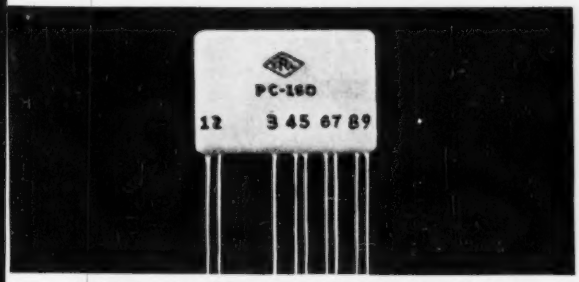
NEW Model 3 AMPEC — A Sub Miniature 3 Stage Speech Amplifier



Here's the latest outgrowth of Centralab's constant research in Printed Electronic Circuit development. The remarkably small dimensions of this new amplifier unit are approximately $1\frac{3}{32}$" x $\frac{15}{16}$" x $\frac{11}{32}$". Check coupon for Technical Bulletin 42-130.

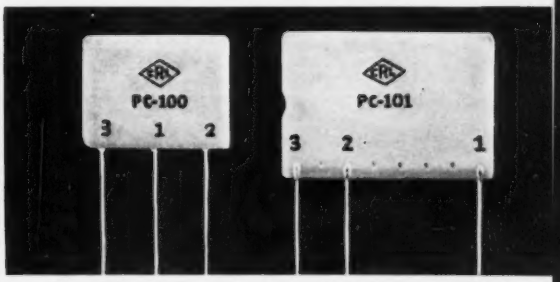
Circuits = BIG SAVINGS

50% Less Soldered Connections With Centralab's NEW PENDET



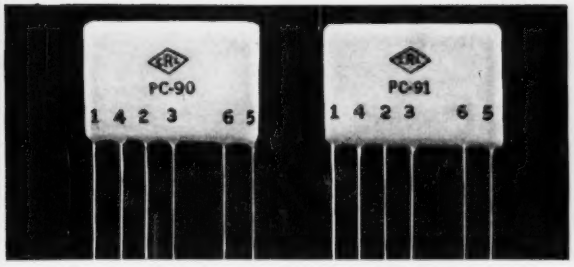
PENDET consists of 5 capacitors and 4 resistors in a single plate with only 9 leads. Similar to the popular AUDET, it is designed to couple the diodetriode and pentode tubes in the output stage of AC-DC sets. Check coupon for Technical Bulletin 42-149.

82% Less Soldered Connections With P.E.C. VERTICAL INTEGRATOR



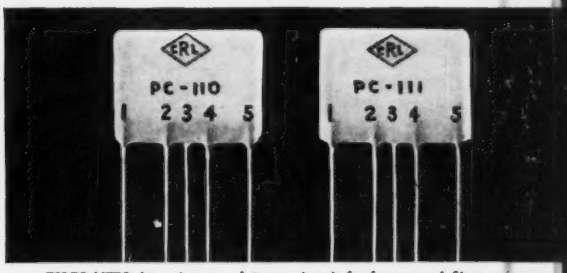
Centralab Vertical Integrators give you big savings in assembly of TV vertical integrator networks. One type consists of 4 resistors and 4 capacitors brought out to 3 leads . . . reduces former 16 soldered connections to 3! Check coupon for Technical Bulletin 42-126.

50% Less Soldered Connections With Centralab's PENTODE COUPLATE



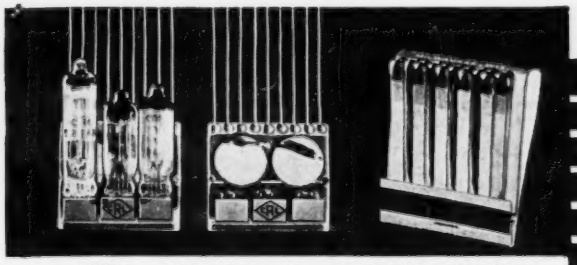
Pentode couplates are complete interstage coupling circuits consisting of 3 capacitors and 3 resistors on a small 6 lead ceramic plate. Compared with old-style audio circuits, they actually reduce soldered connections 50%—wiring errors accordingly. Technical Bulletin 42-128.

28% Less Soldered Connections With NEW FILPLATE



FILPLATES (2 resistors and 2 capacitors) for bypass and filter application in TV, FM and AM, where filter networks of comparable component values and layout are needed. Smaller than special delivery stamp. Save vital low wattage resistor stocks. Technical Bulletin 42-131.

Standard Model 2 AMPEC Miniature 3 Stage Speech Amplifier



AMPEC — A full 3-stage speech amplifier. Provides highly efficient performance. Size 1¼" x 1⅛" x .340" over tube sockets! Used in hearing aids, mike preamps and other applications where small size and outstanding performance counts. Technical Bulletin 42-117.

Centralab

Division of GLOBE-UNION INC. • Milwaukee

Centralab, Div. of Globe-Union Inc.
914 East Keefe Avenue, Milwaukee 1, Wisconsin

Please send me the Technical Bulletins on Printed Electronic Circuits as checked below:

☐ 42-24 ☐ 42-117 ☐ 42-126 ☐ 42-127 ☐ 42-128
☐ 42-129 ☐ 42-130 ☐ 42-131 ☐ 42-149

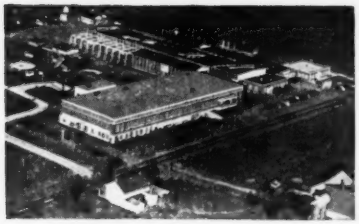
Name.....

Address.....

Company.....

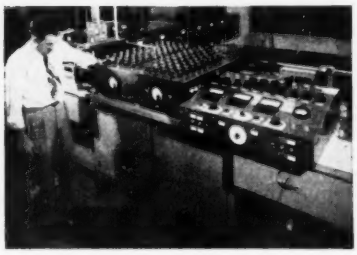
Title.....

With our hands full today...we've our eye on tomorrow



Buildings . . . enclosing more than 4 acres —all devoted to the development, production and testing of fine small tubing.

Men and Machines...fabricating, inspecting and finishing parts to meet the most exacting specifications.



Engineering . . . laboratory equipment for all kinds of testing, including emission characteristics of nickel cathode materials.

Here at Superior we produce quantities of quality parts for the Electronics Industry. Our research engineers are constantly at work to improve these products and to develop new parts to do the job better. Production-wise we're working just as constantly to produce more and more of these better products for you.

During the year 1950, we doubled our disc cathode capacity, added over 50% to Seamless cathode capacity. Through the same period we almost doubled the number of machines making Lockseam cathodes . . . more than doubled capacity. 1950 production of Lockseam cathodes increased 280% over 1949. Demand kept pace with the increase.

Plans for the future include the installation of new machines and the improvement of already good processes so that the Electronics Industry's coming needs may be as well met as its past demands.

Then as now, we at Superior will deliver truly superior small tubing products to do tough jobs better. Superior Tube Company, 2500 Germantown Ave., Norristown, Pa.

Which Is The Better For Your Product . . .

SEAMLESS . . . ? The finest tubes that can be made. Standard production is .010" to .121" O.D. inclusive, with wall thicknesses of .0015" to .005". Cathodes with larger diameters and heavier walls will be produced to customer specification.

Or LOCKSEAM* . . . ? Produced directly from thin nickel alloy strip stock, .040" to .100" O.D. in standard length range of 11.5 mm to 42 mm. Round, rectangular or oval, cut to specified lengths, beaded or plain.

Superior

THE BIG NAME IN SMALL TUBING

All analyses .010" to ¾" O.D.
Certain analyses (.035" max. wall) Up to 1¾" O.D.

*REG. U.S. PAT. OFF. SUPERIOR TUBE COMPANY • Electronic Products for export through Driver-Harris Company, Harrison, New Jersey • Harrison 6-4800

LEADING TV MANUFACTURERS REPORT—

G.E.'s ELECTROSTATIC-FOCUS TUBES GIVE THE *Sharpest* FOCUS OF ALL!

17RP4/17HP4
17VP4
20HP4-A
21LP4
21LP4-A

Comparative tests proved General Electric tubes far superior in needle-sharp distinctness!

FOUR large builders of TV receivers ran their own detailed tests of new G-E zero-focus types against other makes of electrostatic tubes. In every case, General Electric tubes gave pictures with *greater sharpness and definition over the entire viewing area!*

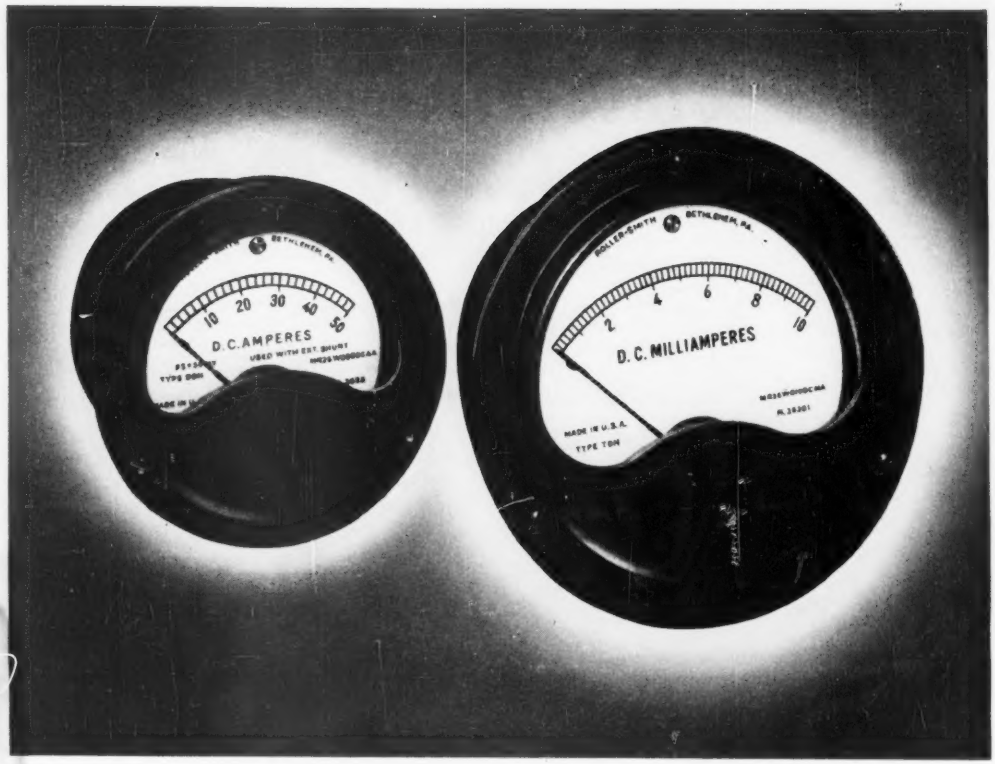
● Improved gun design, precision manufacture, share the credit for this G-E contribution to a TV industry that continues to move ahead despite metal shortages and a heavy defense load.

● Saving precious cobalt, nickel, and copper—needing no receiver focus control, which means simpler TV operation—General Electric's new zero-focus tubes have this third big advantage: they produce outstandingly clear, vivid pictures!

● Five types in popular sizes are listed above. Wire or write for complete facts about the tubes in which you are interested as TV designer or manufacturer! *Electronics Division, General Electric Company, Schenectady 5, New York.*

You can put your confidence in—

GENERAL ELECTRIC



Roller-Smith
Ruggedized Instruments

Shock-Proof • Vibration-Proof • Weather-Proof

Roller-Smith announces production of hermetically sealed *Ruggedized* 2½" and 3½" instruments conforming to MIL-M-10304.

In addition to *Ruggedized* instruments, a complete line of hermetically sealed and unsealed types in conformance with Government specifications are available.

ROLLER SMITH

ROLLER-SMITH CORPORATION
BETHLEHEM, PENNSYLVANIA

Our Defense Program Faces a Crisis

A major crisis will soon confront our defense program.

It is not a crisis in raw materials. To find enough materials, from steel to cobalt, for defense production is a serious problem. But it is one that is being solved.

It is not a crisis in manpower. Shortages of workers with special skills hamper production, but these shortages are being relieved, slowly.

It is not a crisis in manufacturing capacity. American industry's record-breaking expansion is, with very few exceptions, keeping abreast of defense needs.

The coming crisis will be one of finance. It will rise from our failure to provide the means to PAY FOR the defense program we now have under way.

A $15 Billion Deficit?

Congress has approved a defense program which is scheduled to raise *total* federal spending in the year from June, 1952, to June, 1953, to somewhere between $85 and $90 billion. Additional appropriations for more air power and atomic development, which are now proposed, would add several billion dollars.

But Congress has not approved a tax plan to match such spending. With the new levies enacted in this session, tax collections during the 1952-53 fiscal year are estimated to fall somewhere between $70 and $75 billion. That would be roughly $15 billion short of balancing the budget. If the defense program is expanded, the deficit will be that much greater.

We have not yet felt the impact of the crisis that would accompany a federal deficit of this magnitude. Federal tax collections currently are big enough to balance federal expenditures. But the defense program is scheduled to boost the annual rate of federal expenditures $25 billion in the next year.

To Meet the Crisis

By January the crisis will be clearly in sight.

Then the President will present his budget. After that, Congress must act to close the broad gap between government income and government spending. If it fails to do that, the whole defense program will be menaced by weakness in its financial foundations. That weakness might well take the form of another destructive wave of inflation.

We have three ways to meet this crisis.

The best approach, of course, is to cut unessential expenditures. That can make a real dent in the deficit. The second is to collect more

taxes. The third, and by all odds the most dangerous, is to have the federal government meet its deficit by going deeper into debt. Borrowing, which might feed inflation, can easily lead to disaster.

Near Income Tax Limits

It will not be possible to raise taxes to meet the deficit merely by increasing further the rates on corporations and on persons in the upper income brackets. Congress has about scraped the bottom of that barrel.

The Senate Finance Committee said as much in reporting this year's tax bill. The Committee reported that it had "serious doubts as to the feasibility of raising any substantial additional amounts of revenue from income tax sources." The Committee observed that recent tax legislation brings the burdens of most corporate and individual income taxpayers close to the World War II peaks, and actually carries the rates paid by many taxpayers above those peaks.

Our ramshackle federal tax system must be thoroughly overhauled in order to broaden the tax base if it is to produce more revenue—without doing much more harm than good.

The shocking fact is that no one seems ready to act along any line that might enable us to surmount the crisis.

That fact of itself aggravates the coming crisis. And next year's presidential election doesn't make it any easier to move effectively. Both parties will shrink even more than normally from backing any program that might irritate any considerable number of voters.

If we are to meet this crisis on the tax front in an orderly way, the technical work should be in progress right now. To a large extent it is being ignored.

If we are to enforce the vitally essential program of government economy, there is the same urgent need to get under way the spade work that is required.

And if—as a last miserable expedient—we decide to let the federal government drift deeper into debt, it must have a well-developed program of borrowing from individuals and other investors, such as insurance companies, rather than from the commercial banks. Borrowing from commercial banks might speedily translate the deficit into more and more price inflation. No adequate program of borrowing from savings is now in sight.

Now Is the Time

It is possible, of course, that international relations may improve sufficiently to make it safe for us to slow down the rearmament program. If that should happen, the fiscal crisis would not be so critical. But that kind of good fortune has been notably absent in recent years.

Lenin, patron saint of Communism, is quoted to the effect that to destroy a political and social system such as ours "you must debauch its money."

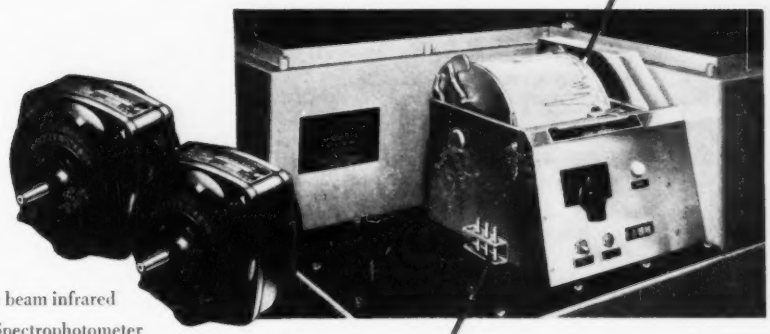
We shall set democracy to digging its own grave if, through our preoccupation with politics during the presidential campaign, we pave the way for further debauchery of our money.

If we really want to avert that disaster, now is the time for us to get going.

Once the crisis is full upon us, it will be too late.

McGraw-Hill Publishing Company, Inc.

Holtzer-Cabot motors help the Spectrophotometer record "signatures" on a beam of light!



The double beam infrared recording Spectrophotometer developed and manufactured by Baird Associates of Cambridge, Mass., is an ingenious instrument which has proven itself invaluable in quickly and surely identifying and defining complex chemical compositions.

The Spectrophotometer analyzes organic samples by passing an infrared beam through them. The resulting vibration and energy absorption of the sample's molecules form a pattern on the Spectrophotometer's recording drum chart. Comparison of the sample's recorded characteristics with those of known elements reveals the sample's identity and composition.

Rigid specifications were laid down for the motors to operate the variable speed drive used in the Spectrophotometer. Some of the requirements:

- two winding, two speed
- synchronous operation at one speed
- smooth transition between speeds
- all speeds must be reversible
- low vibration and magnetic leakage fields
- small size—low power
- completed design must be applicable to *all* previous models

Holtzer-Cabot engineers, working closely with Baird Associates, developed two different adaptations of the H-C R-25, which met specifications perfectly. These motors are now standard components of the Spectrophotometer and are giving satisfactory, dependable service.

This is but another example of Holtzer-Cabot's ability to meet the most exacting specifications in small-motor applications. Holtzer-Cabot motors range from 1/2000 up through 1½ H.P., from 24,000 RPM to 1 revolution per day!

HOLTZER-CABOT

DIVISION OF NATIONAL PNEUMATIC CO., INC.

BOSTON 19, MASSACHUSETTS

"builders of fine electric motors for three quarters of a century"

Photographs through courtesy of Baird Associates, Cambridge, Mass.

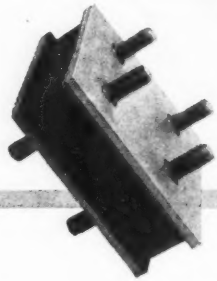
How MB can help you

MEET MILITARY SPECIFICATIONS ON VIBRATION

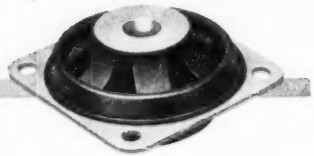
DOES YOUR MILITARY PRODUCTION require vibration *testing?* Shock *absorption*—vibration *isolation?* Representative of MB's specialized vibration engineering, these products show that, from a single source, you can get the equipment and information you need to meet your requirements. For example:

1. MEASUREMENT of vibration with MB vibration pickup and meter supplies data for study of disturbing frequencies and for design adjustments. The electrically damped and highly sensitive pickup is convertible for horizontal or vertical operation. Meter gives you accelerations, velocities or displacements of the vibrations directly. Made for each other, the two are the "eyes" for any vibration testing program.

2. SHAKE TESTING TO MIL-E-5272 and 41065-B is easily accomplished with MB Vibration Exciters. Model S-3 shown delivers 200-lb force. Others available with 10-lbs to 2500-lbs force ratings—all easily, quickly and accurately controlled for force and frequency.



3. ISOMODE* SHOCK MOUNTS have been developed for supporting and protecting aircraft engines from damage while transported in crates or "cans." High load capacity combined with high deflection capacity provides good absorption of shock. **Reg. U.S. Pat. Off.*



4. MIL-I-5432 (AN-I-16a) can be met with the Type 17 ISOMODE Mount. This unit available for loads from 0.5 to 100 pounds, and controls all modes of vibration with equal efficiency because of equal spring rate in all directions.

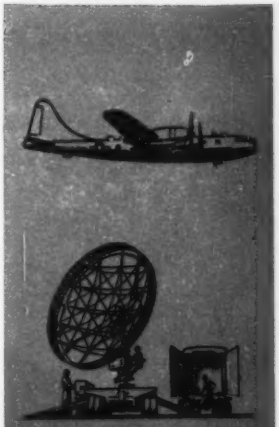
Remember, if you need help with a vibration problem, you can save yourself time and work by contacting MB's vibration specialists. For details on any of the above products, address your inquiry to Dept. N5.

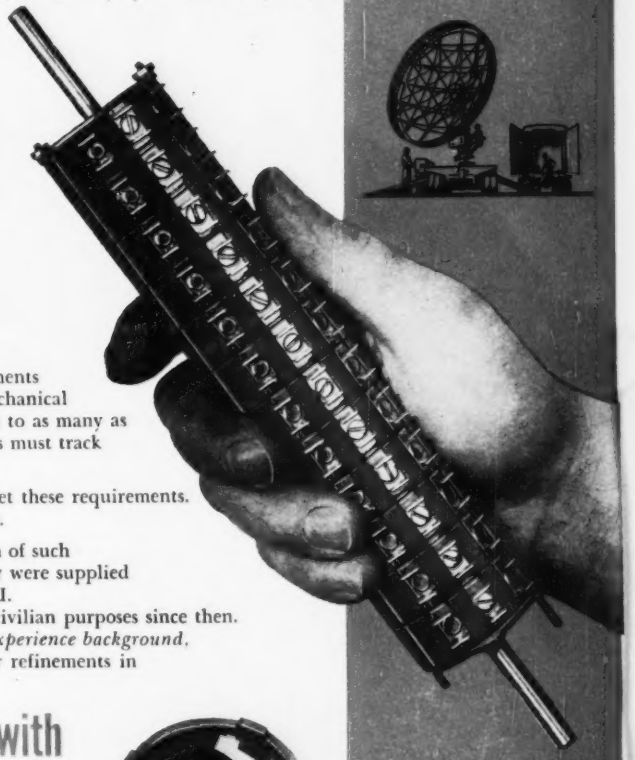
THE MB MANUFACTURING COMPANY, Inc.
1060 State St., New Haven 11, Conn.

PRODUCTS FOR MEASUREMENT . . . REPRODUCTION . . . AND CONTROL OF VIBRATION

PRECISION

Controls





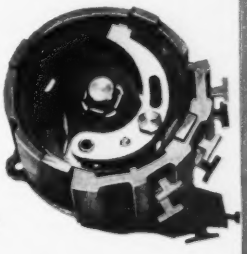
At the *very heart* of highly critical equipment such as electronic computers, electronic gunsights and radar assemblies, the control requirements call for outstanding electrical and mechanical precision. Indeed, from single section to as many as twenty sections, the precision controls must track with mathematical accuracy.

Clarostat Series 42 Controls fully meet these requirements. Thus *the climax in precision controls.*

Clarostat has made the major portion of such precision controls in use today. Many were supplied to the armed forces in World War II. Many more have been supplied for civilian purposes since then. And now, *based on an unparalleled experience background,* Clarostat engineers offer you further refinements in their latest Series 42 design.

You can stand pat with CLAROSTAT

Engineering Bulletin No. 142 sent on request. And remember, when your control or resistor requirements call for *quality, quantity* and *economy,* you can meet them with Clarostat's engineering and production facilities. *Submit that problem!*



New Clarostat Series 42 potentiometer. Available in single and multiple assemblies up to 20 sections. Precision windings to plus/minus 0.5% and better. Positive contact rotor, smooth rotation, minimum wear. Perfect tracking of all units in assembly. No backlash or play. Rotor of each potentiometer mounted on centerless-ground shaft passing through all sections.

Controls and Resistors

CLAROSTAT MFG. CO., INC., DOVER, NEW HAMPSHIRE

In Canada: Canadian Marconi Co., Ltd., Toronto, Ontario

CLAROSTAT

Announcing

Remember, Sealtrons protect sensitive parts

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Philadelphia	S. Victor Malta Box 205 Camden, N. J. Phone—Collingswood 5-5185W
Cleveland Pittsburgh Buffalo	Richard Snetsinger 1836 Euclid Avenue Cleveland, Ohio Phone—Main 1-4381
Detroit	Richard B. Harper 814 Fisher Building— Detroit, Mich. Phone—Trinity 1-4262
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Los Angeles San Francisco	Jackson Edwards 2946 Belden Drive Los Angeles 28, Calif. Phone—Hudson 2-1133
St. Louis Kansas City	R. Harper 4356 Maryland Avenue St. Louis, Mo. Phone—Jefferson 6369
Dallas	Edward F. Aymond, Jr. 4308 Maple Ave., Dallas 9, Texas Phone—Logan 1970
Montreal	Harry Schwartz 145 Normand Street Montreal, Quebec Phone—Marquette 6736

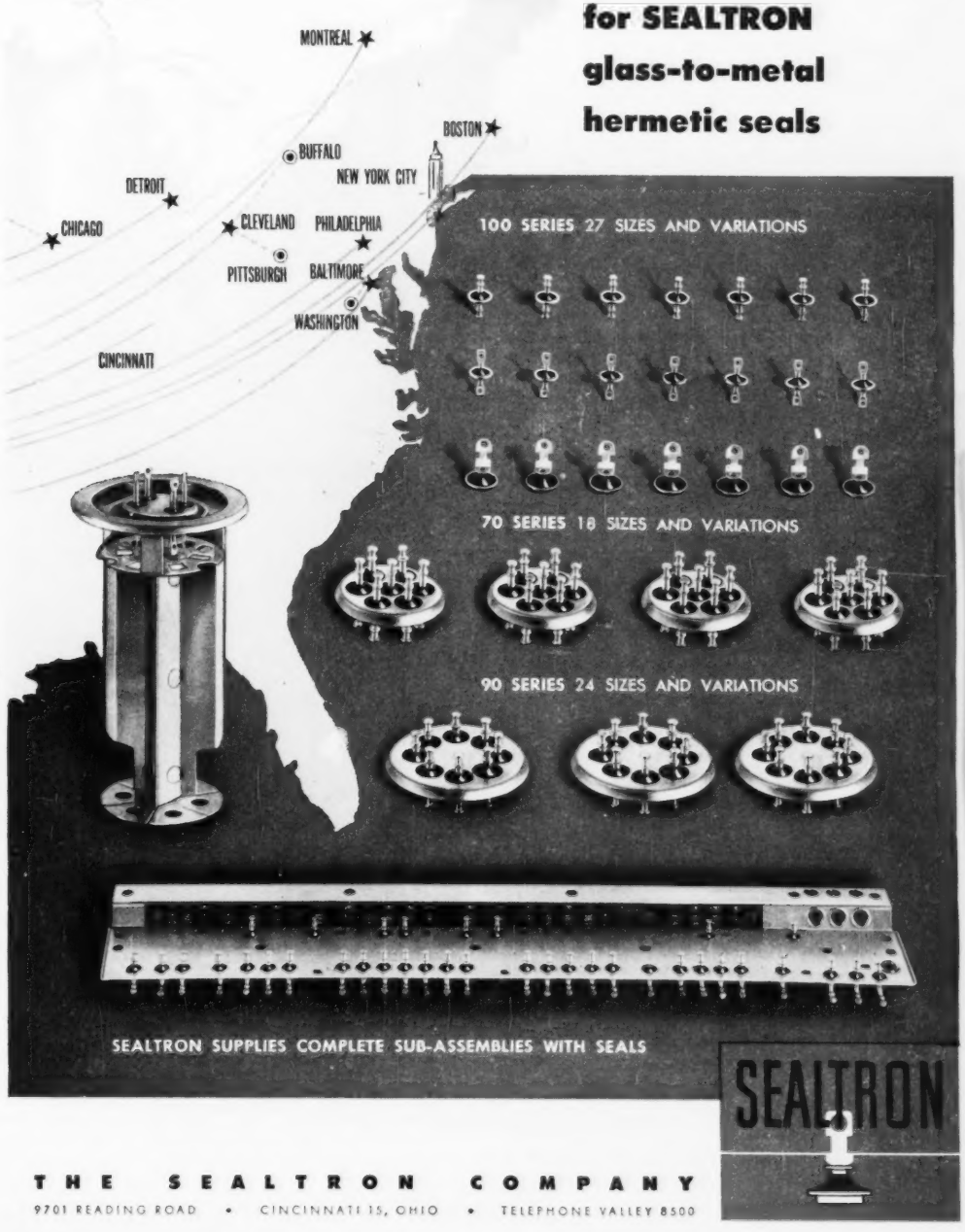
This is YOUR plant!

SEALTRON'S new plant and general offices in Cincinnati, Ohio utilize the most advanced techniques and manufacturing methods ever conceived for the production of hermetic seals... to give you

IMMEDIATE DELIVERY
HIGHEST QUALITY
REALISTIC PRICES

25 sales representatives

for SEALTRON glass-to-metal hermetic seals



SEALTRON

THE SEALTRON COMPANY

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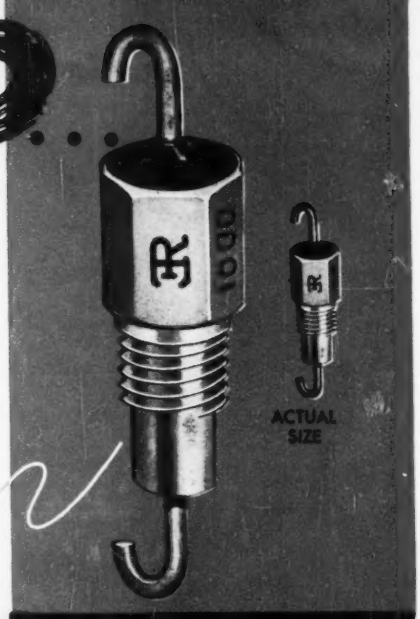
RUGGED . . .

is the word for the new Erie Style 327

FEED-THRU CERAMICON®



ERIE adds another outstanding capacitor to the most complete line of ceramic by-pass units available. Style 327 Feed-Thru design is a further result of continued Erie development in accomplishing ruggedness in components to meet severe military requirements and to give trouble-free service in other electronic applications. It embodies the following outstanding features:

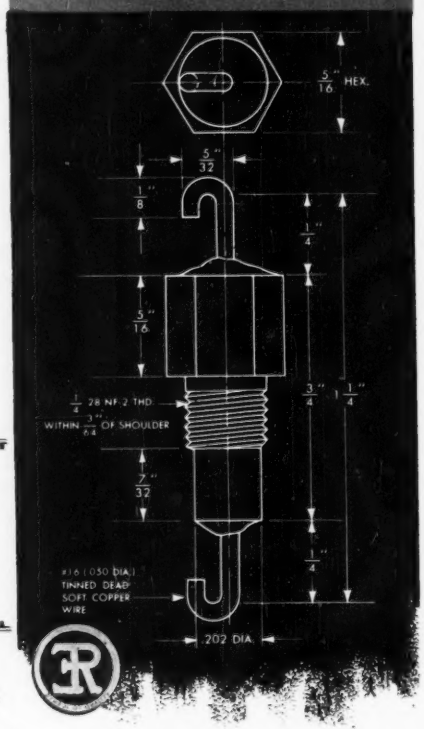
1. Mechanically rugged. Tubular ceramic capacitor is sealed at both ends in thermosetting low loss insulation.
2. Very low and uniform inductance path to ground.
3. Electrical shielding is provided by means of the grounded metal case.
4. All internal connections are soldered; no pressure contacts.
5. Hook type terminals provide sturdy connection tie points; also facilitate precision spacing of leads from other components where required in VHF and UHF circuits.

Specifications:

Standard capacitance values, mmf: 10, 33, 47, 68, 82, 100, 470, 680, 1000

Capacitance tolerance: ± 20% or + 80%, —20%

Rated voltage: 500 WVDC (values through 100 mmf also available in 1000 WVDC rating)



OTHER ERIE FEED-THRU CERAMICONS:

Style 357, rigid hooked wire lead, maximum capacitance 1000 mmf.
Style 362, #20 straight pig-tail wire lead, maximum capacitance 1500 mmf.
Style 2416, rigid wire lead, cadmium plated shell for solder mounting, maximum capacitance 1500 mmf.
Style 2418, no center lead, cadmium plated shell for solder mounting, maximum capacitance 1500 mmf.

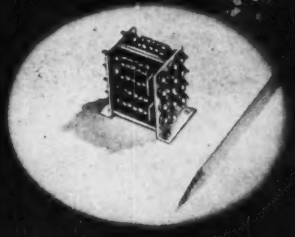
Electronics Division

ERIE RESISTOR CORP., ERIE, PA.

LONDON, ENGLAND . . . TORONTO, CANADA

Announcing a GERMANIUM

MUST YOUR EQUIPMENT BE RADIO INTERFERENCE FREE?



8 circuit miniaturized filter for wide band RF Interference Suppression.

IF YOURS IS A TOUGH RF INTERFERENCE PROBLEM — LET FILTRON SOLVE IT....

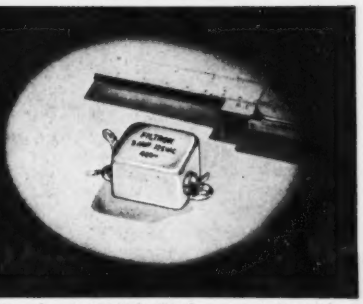
FILTRON'S engineering department, cooperating with engineers of leading companies, has solved RF Interference Suppression problems throughout the country.

If your equipment must meet the RF Interference limits set by the military specifications, consult with FILTRON'S engineers in the earliest stages of design. FILTRON can furnish RF Interference Suppression Filters whose size, weight and overall configuration will fit into your equipment.

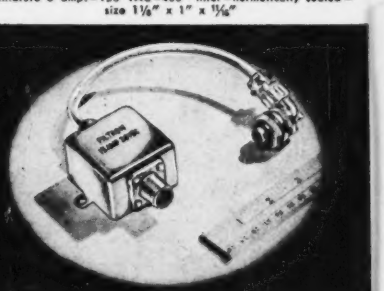
FILTRON has *custom designed* over 1000 different types of RF Interference Suppression Filters for equipment that meets military RF Interference Suppression limits and specifications.

FILTRON'S completely equipped screen rooms are always available for the RF Interference testing of your units and equipment.

An inquiry on your company letterhead will receive prompt attention.



Miniature 3 amp.–125 VAC–400~ filter–hermetically sealed–size 1⅛" x 1" x 1⅛"



15 amp.–28 VDC filter, size 2" x 2" x 1¼", with pressurized AN connectors–high attenuation from 150 KC to 400 MC.

FILTRON can best solve your RF Interference problems because:

- FILTRON'S engineering, research and design divisions are staffed by experienced RF Interference Suppression filter engineers.
- FILTRON'S modern shielded laboratories are equipped to measure RF Interference from 14 KC to 1000 MC in accordance with military specifications.
- FILTRON'S production facilities, comprising a capacitor manufacturing division, coil winding division, metal fabrication shop, metal stamping and tool and die shops, are exclusively producing the highest quality components for FILTRON'S RF Interference Suppression Filters.
- FILTRON'S extensive production facilities permit us to meet your delivery requirements. NOW!

RF INTERFERENCE SUPPRESSION FILTERS FOR:

Motors	Dynamotors
Generators	Power Plants
Inverters	Actuators
Electronic Controls	Gasoline Engines

And other RF Interference producing equipment

filtered by FILTRON

LOCKHEED XF-90

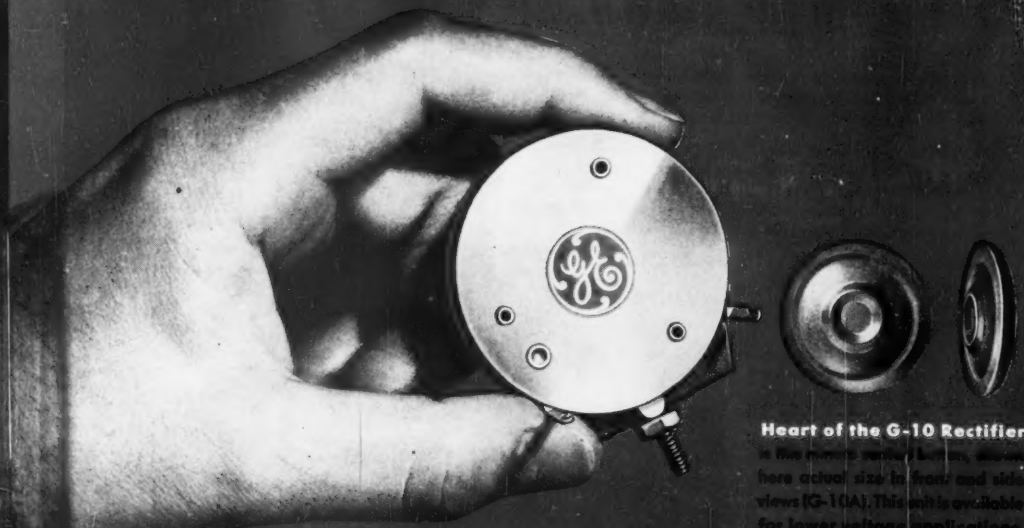
THE FILTRON CO., INC.

FLUSHING, LONG ISLAND, NEW YORK

LARGEST EXCLUSIVE MANUFACTURERS OF RF INTERFERENCE FILTERS

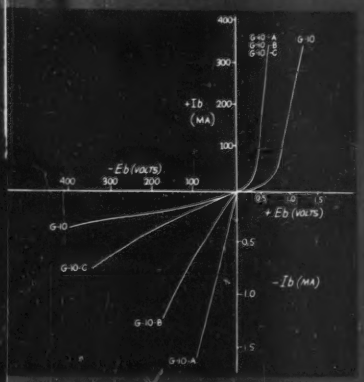
Revolutionary NEW POWER RECTIFIER!

GERMANIUM

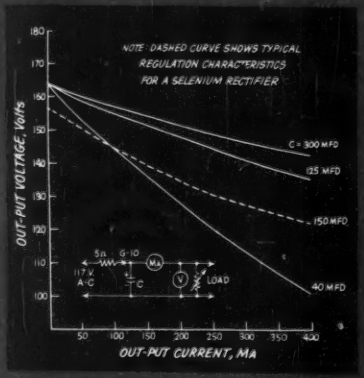


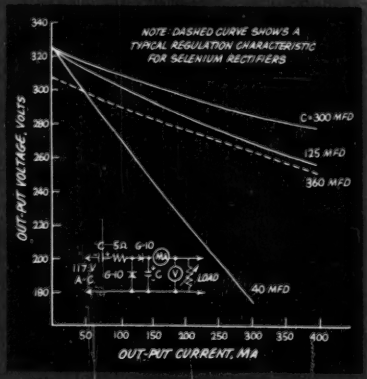
Heart of the G-10 Rectifier

is the miniature germanium button, shown here actual size in front and side views (G-1(A)). This unit is available for lower voltage applications.



Typical Current-Voltage Characteristics





Regulation Characteristics

POWER RECTIFIER

G-E Research Advances New Principle of Area Rectification . . . Usage with Large Currents and Exceptionally Low Losses Now Possible

Can You Use These Outstanding Features?

- **Higher Output Voltage**—15 volts more B+ in typical TV power supply due to rectification efficiency up to 90%
- **Longer Life**—Moisture and fume resistant...gasket-sealed units
- **Lower Forward Resistance**—Approx. 3.5 ohms forward resistance at 350 ma
- **Higher Current Capacity**—400 ma average dc current
- **Higher Peak Inverse Voltage**—400 volts
- **Higher Back Resistance**—approx. 1 megohm at 350v
- **Smaller Size**—smaller than comparably rated dry rectifiers of other types

Specifications

Description and Maximum Ratings
Type G-10

Ambient Temperature		40°C	55°C	65°C
RMS Input Voltage (Max.)		130	130	130 Volts
RMS Current (Max.)		1.2	1.2	.2 Amps
D-C Output Current (Max.)		400	350	50 Ma
D-C Surge Current (Max.)		25	20	2.5 Amps
Peak Forward Current (Max.)		3	3	.5 Amps
Peak Inverse Voltage (Max.)		400	400	400 Volts
Full Load Voltage Drop (Max.)		1.5	1.4	1.3 Volts
Operating Frequency (Max.)		50	50	50 Kc
Single Rectifier Types		**G-10A**	**G-10B**	**G-10C**
RMS Input Voltage (Max.)	25°C	32	50	65 Volts
	40°C	32	50	65 Volts
RMS Current (Max.)	25°C	.6	.6	.6 Amps
	40°C	.5	.5	.5 Amps
D-C Output Current (Max.)	25°C	200	200	200 Ma
	40°C	150	150	150 Ma
D-C Surge Current (Max.)	25°C	10	10	10 Amps
	40°C	8	8	8 Amps
Peak Forward Current (Max.)	25°C	1.5	1.5	1.5 Amps
	40°C	1.2	1.2	1.2 Amps
Peak Inverse Voltage (Max.)	25°C	100	150	200 Volts
	40°C	100	150	200 Volts
Full Load Voltage Drop (Max.)	25°C	.8	.8	.8 Volts
	40°C	.7	.7	.7 Volts
Operating Frequency (Max.)	25°C	50	50	50 Kc
	40°C	50	50	50 Kc

● These rectifiers are now in pilot production. To purchase sample quantities, call the G-E Electronics Division Tube Dept. office near you or wire us: *Commercial and Government Equipment Dept., Electronics Park, Syracuse, N. Y.*

● *A newly printed bulletin on the G-10 Germanium Power Rectifier will be sent to you on request.* General Electric Company, Section 412, Electronics Park, Syracuse, New York.

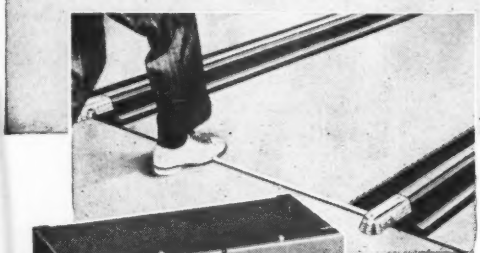
You can put your confidence in—

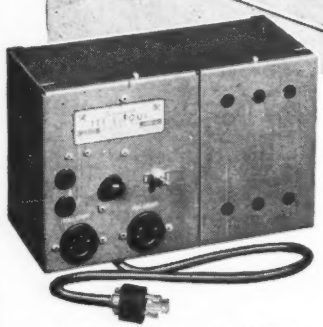
GENERAL ELECTRIC

Seletron
SELENIUM RECTIFIERS

May be up your alley, too!

...AS THEY ARE FOR THE BRUNSWICK-BALKE-COLLENDER COMPANY



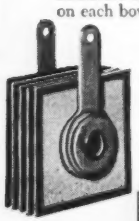


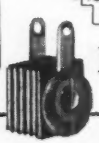
Illustrated above is the "Tel-E-Foul" control box. When the bowler oversteps the foul line the electronic brain conveys an impulse causing a light to flash above the alley. A 75 MA SELETRON miniature is built into the control box on each bowling lane.

The new "Tel-E-Foul," photo-electric Foul Indicator produced by The Brunswick-Balke-Collender Company, famous manufacturer of bowling equipment, includes 75 MA SELETRON miniatures in its electronic circuits.

SELETRON Selenium Rectifiers are the choice of an increasing number of manufacturers in diversified fields because they are so thoroughly dependable under all types of grueling conditions. SELETRON is available in the miniature sizes required for radio, TV and other electronic circuits, all the way up to heavy duty power stacks used in a wide range of industrial applications.

Whenever *you* meet up with a power conversion problem, no doubt SELETRON engineers can be of substantial assistance in recommending the right rectifier for your needs. Write us today!





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RADIO RECEPTOR COMPANY, INC.

Since 1922 in Radio and Electronics

Sales Dept.: 251 W. 19th St., New York 11, N. Y. • Factory: 84 N. 9th St., Brooklyn 11, N. Y.

Honeywell Mercury Switches

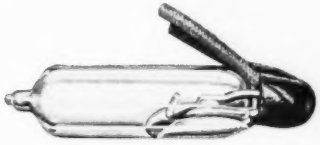
Let a MICRO SWITCH Engineer show you how you can **"use Honeywell Mercury Switches as a principle of good design"**

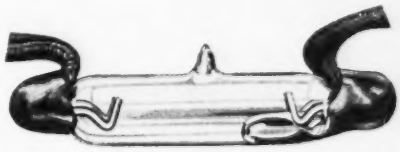
are engineered to solve many complex switching problems

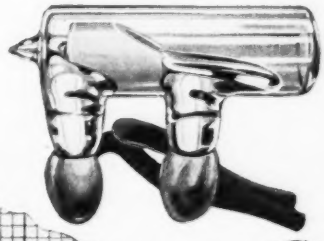
● Honeywell Mercury Switches are ideal for use in applications where tilt motion and low operating force are provided. Because all the switch elements are permanently sealed in glass, they are effective components where dust, fumes, spray and/or splash are present.

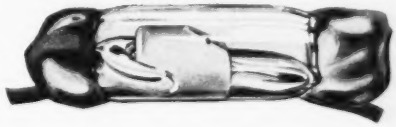
Often the proper tilt motion to permit the use of Honeywell Mercury Switches on a given application can be developed in cooperation with MICRO SWITCH engineering field service. These experienced switching specialists will review your requirements as to mounting, actuating linkages, lead supports, terminal blocks and enclosures. Thus you will not only be sure of the switch best suited to your need but have engineering help in developing complete mercury switch assemblies.

There are over 125 designs of Honeywell Mercury Switches from which to select the exact switch characteristics to meet your specific problem. You are invited to write for catalog and to contact your nearest MICRO SWITCH branch office for more complete information.









MICRO Snap-Action Switches...

Honeywell Mercury Switches

MICRO MS SWITCH

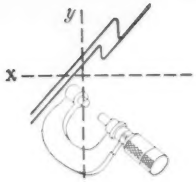
FREEPORT, ILLINOIS

A DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

NOW...

Multiple-point Speedomax recorder at left is a familiar sight in scientific laboratories throughout the world. While the 6 new instruments described below all *appear to be* practically identical, each *is different* from the others.

See how these 6 new Speedomax recorders

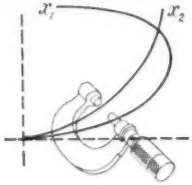


SPEEDOMAX X-Y RECORDER

Automatically plots the relationship between any two variables which can be converted to d.c. signals. Both pen and chart motion are reversible. Instrument records vacuum tube characteristics, hysteresis loops, stress-strain, temperature-elongation, differential thermal analysis curves . . . Applications are as broad as a researcher's imagination. *Write for Folder EM9-420(2).*

SPEEDOMAX ADJUSTABLE RANGE-ZERO RECORDER

Automatically plots voltage representing force, weight, temperature, temperature-difference, speed . . . or any other condition. Suppressing ZERO pushes *non-significant* mv off scale. Adjusting RANGE spreads few significant mv right across chart. Range *continuously* adjustable from —0.1 to +1 mv . . . up to —2 to +20 mv; zero suppression, from —50 to +50 mv. Folder ND46(2).



SPEEDOMAX 2-PEN RECORDER

Automatically plots 2 curves on 1 chart simultaneously . . . overlapping or side-by-side. Follows minute shifts in fast-changing variables with ease. A "2-in-1" recorder, it takes any *two* standard Speedomax ranges. Circuits work with thermocouples, Thermohms, strain gages, tachometers, thermal converters, pH cells . . . or most other primary elements. *Write for Folder EM9(1).*

For further information and application data on any Speedomax electronic recorders, just write our nearest office or 4907 Stenton Ave., Phila. 44, Pa.

LEEDS &

Jrl. Ad. ND46(5)

SPEEDOMAX *presents*

6 precision electronic servants to speed plotting of test data

AS the tempo and complexity of today's research and engineering activities accelerate, more and more investigators are stepping up efficiency through use of time-saving Speedomax recorders. Tireless automatic assistants, these electronic servants are taking over the chores of routine computation . . . eliminating tedious manual plotting of data.

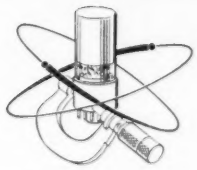
Especially timely are these 6 new Speedomax recorders developed specifically for laboratory use. While each is a *specialist*, it is also designed for a diversity of applications.

Common denominators for all six are traditional Speedomax precision and high-speed response. Recording pens can whip across the 9¾" chart in as little as *1 second*, if the application demands, though speeds of 2 and 3 seconds full scale are also available. Balancing is velocity-damped to take advantage of this high speed.

Alert to the most minute variation in "X," the sensitive electronic balancing system is the perfect complement for the instrument's accurate null-balance measuring circuit. Thorough filtering, shielding and guarding screen out transients . . . permit use of Speedomax in the presence of severe stray fields.

Net result: the investigator can follow complex, fast-changing variables with ease and confidence . . . knowing that the record on his Speedomax is faithfully following the actual function being measured.

can solve your data-logging problems . . .



SPEEDOMAX PHOTOMULTIPLIER TUBE RECORDER

Automatically plots accurate record of light intensity or other low level radiation. Can be direct-connected to photo-multiplier tubes . . . eliminating separate preamplifier. Available by switch are four ranges: 0.02, 0.06, 0.2, and 0.6 μs. Dark current or noise of photo-multiplier tube is readily offset by built-in manual compensator. *Write for DS-240-70-EM9(1) to (3).*

SPEEDOMAX POWER LEVEL RECORDER

Automatically plots radiation patterns of antennas and hydrophones . . . frequency characteristics of filters, amplifiers, loudspeakers, etc. Applies accurate "insertion loss" principle of measurement. Recorder can be supplied with full scale reading of 20, 30, 40, 50, or 60 db, referred to a base level of as little as 0.02 microwatt. *Write for Folder ND46-51(1).*

SPEEDOMAX PRECISION THERMOMETER RECORDER

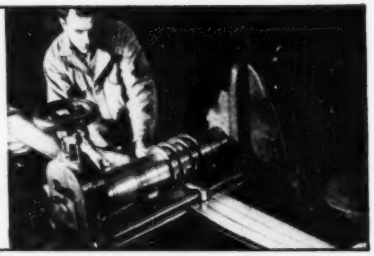
Automatically plots temperature curves for calorimetry, freezing and boiling points . . . reads resistance of platinum thermometer to five significant figures. An "automatic Mueller Bridge," it covers the entire range from —260 to +500 C with precision of ±0.01 C. Automatic range-changing mechanism expands chart width 100 times. *Write for Folder ND46-33-240(1).*

NORTHRUP CO. *40 years of precision recording*
20 years of electronic recording

CHASE warehouses from coast to coast offer complete metal cutting services!

These 11 Chase warehouses do SLITTING

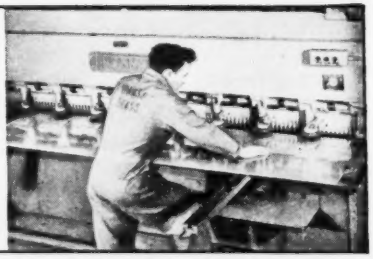
CINCINNATI
PROVIDENCE
LOS ANGELES
INDIANAPOLIS
CHICAGO
PHILADELPHIA
MILWAUKEE
ST. LOUIS
DETROIT
NEW YORK
NEWARK



These 7 Chase warehouses do SHEARING

CHICAGO
PHILADELPHIA
MILWAUKEE
ST. LOUIS
DETROIT
NEW YORK
NEWARK

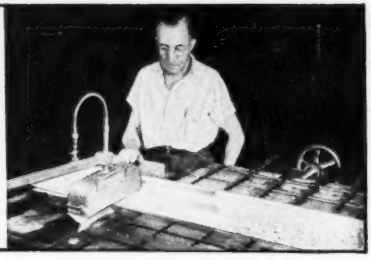
These warehouses also do slitting



These 4 Chase warehouses do SAWING

DETROIT
NEW YORK
NEWARK
CHICAGO

These warehouses also do slitting and shearing



When it comes time for slitting, shearing or sawing, check the Chase Warehouses listed above for the cutting facilities each of them have.

Naturally, this work is done to your specifications on orders for metals we are able to fill. We'll help out, too, on *your* brass, bronze, copper, aluminum, steel, fibreboard or other materials. Just tell us how you want it. The work will be done accurately.

As usual—call Chase!

Chase BRASS & COPPER

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

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Atlanta	Dallas	Los Angeles	Philadelphia	Seattle
Baltimore	Denver†	Milwaukee	Pittsburgh	Waterbury
Boston	Detroit	Minneapolis	Providence	
Chicago	Houston†	Newark	Rochester†	(†sales office only)
Cincinnati	Indianapolis	New Orleans	St. Louis	

An Isotronic* first

±0.01% AC Regulation!

That's the degree of accuracy attained by Sorensen's new Model 1001 AC Line Voltage Regulator!

Heretofore, the closest regulation in commercially available regulators has been ±0.1%, regardless of manufacturer or circuit approach. Now, Sorensen's continuing study and design refinements have produced a super-accurate regulator — the Model 1001 — as a *standard* catalog item.

GENERAL SPECIFICATIONS

Load range	0 — 1000 VA
Input voltage range	95 — 130 VAC, 1φ, 55 — 63~
Load P. F. range	0.7 lagging to 0.95 leading
Output voltage	115 VAC, 1φ (adjustable from 110-120 volts)
Distortion	2% max.
Time constant	0.1 seconds
Regulation accuracy	±0.01%

The accuracy is *guaranteed* at room temperature, for a resistive load, an input variation of ±10%, and over a two-to-one load change. For *all* other conditions within the specifications, the Model 1001 has a proportionate amount of accommodation.

* Isotronics is a trade marked word pertaining to the electronic regulation and control of voltage, current, power, or frequency.

model 1001

WRITE FOR FULL INFORMATION

Note these extra features

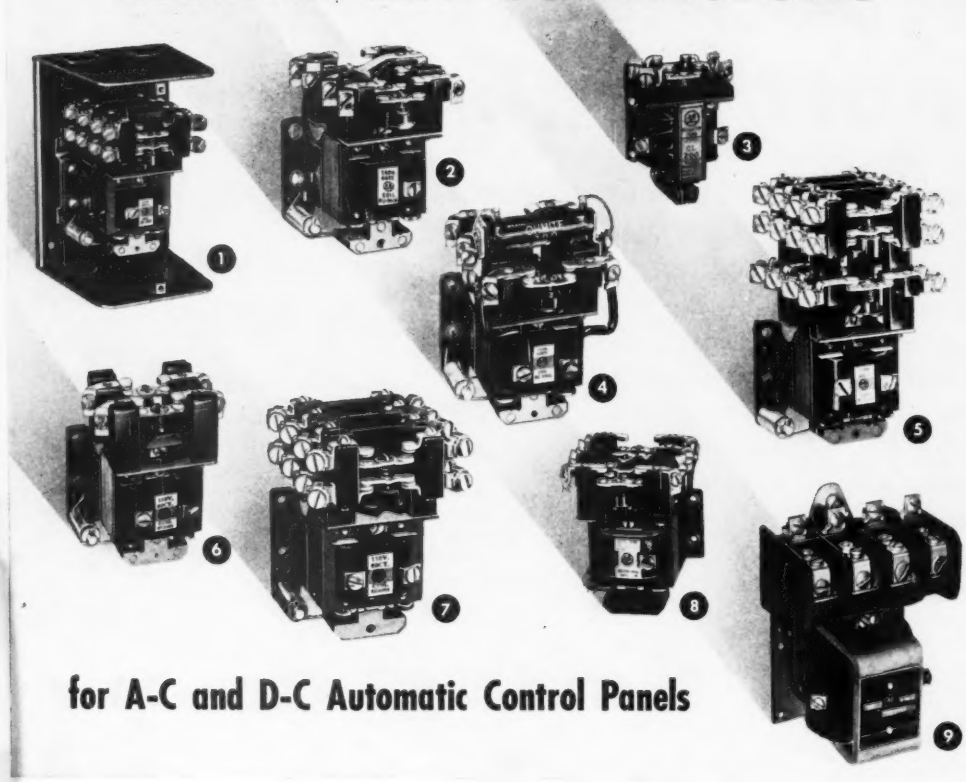
- Combination twist-lock and double-T receptacle, or, output terminals to eliminate contact resistance.
- Three-function output switch for
  1. Normal regulator functioning.
  2. Operation with integral semi-fixed resistance in place of potentiometer.
  3. Direct load connection with the control diode for regulation of voltages other than 115 volts.
- Only FOUR vacuum tubes and NO relays are used.
- All tube filament voltages are regulated for long dependable life.

FOR THE LATEST AND BEST IN ISOTRONICS . . .

Specify **SORENSEN**

SORENSEN AND COMPANY • 375 FAIRFIELD AVE., STAMFORD CONN.

RELAYS and CONTACTORS



for A-C and D-C Automatic Control Panels

Do you need small relays from one to eight poles . . . or contactors up to 900 amperes? You will find these units, and many more, in the Allen-Bradley line, factory-tested for millions of maintenance-free operations.

Type BX universal relays have interchangeable normally open and normally closed contacts. No assembling to change from normally open to normally closed contacts. A few of the relays in the Allen-Bradley line are illustrated above.

Write for Bulletins 700 and 200.

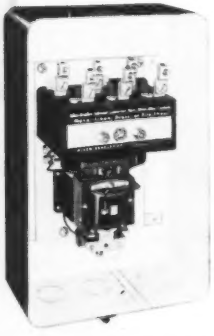
1. Type BX Universal A-C Relay—in Enclosure
2. Type BM Mechanically Held Relay—No Hum
3. Type CL Low Coil Current Relay
4. Type BA 3-Wire Thermostat Relay —Open
5. Type BX 8-Pole Universal Relay—Open
6. Type B 2-Pole A-C Relay—Open
7. Type BX Universal A-C Relay—Open
8. Type BM Mechanically Held Relay—Open
9. Bulletin 202 2-Pole D-C 25-Ampere Relay

Allen-Bradley Company, 110 West Greenfield Ave., Milwaukee 4, Wis.

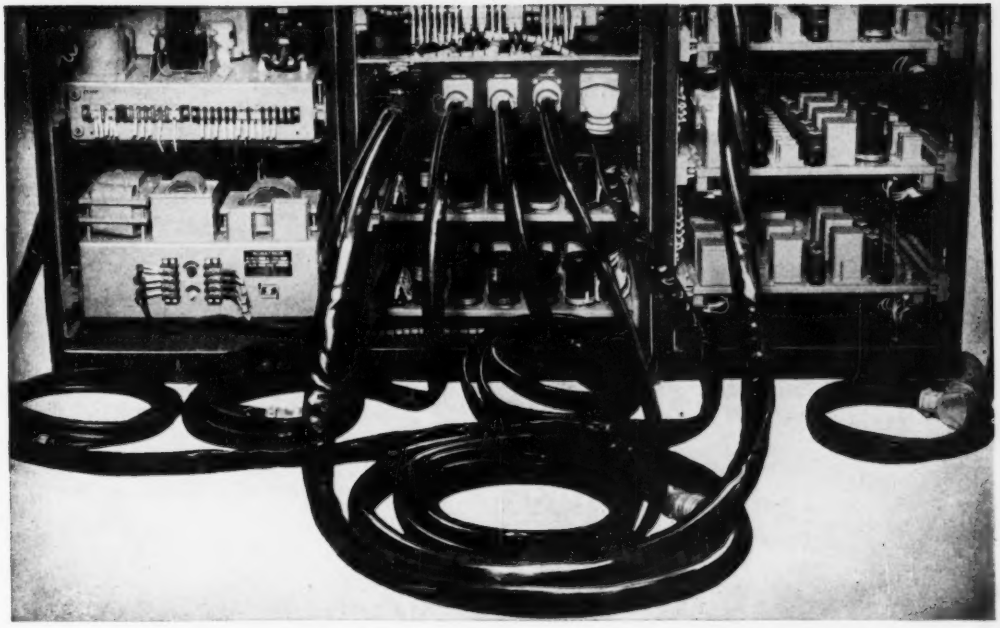
ALLEN-BRADLEY

RELAYS • RESISTORS

QUALITY



Fifty ampere Contactor in general purpose Type 1 Enclosure.



Reeves *saves space* in its Electronic Brain... with IRV-O-LITE Tubing

The Reeves Electronic Analog Computer (REAC) * saves plenty of man-hours in performing complex calculations. And in this Electronic Brain's complicated wiring system, shielding and terminal labeling are done exclusively with IRV-O-LITE XTE-30 Plastic Tubing—saving plenty of *space*.

XTE-30's high dielectric strength of 1,000 vpm (dry) frequently permits the use of *thinner-walled* tubing. Where space is at a premium, follow the example of Reeves and hundreds of other manufacturers—use XTE-30!

You get these *other* advantages, too, with XTE-30 Plastic Tubing: high mechanical strength; lasting flexibility; excellent chemical and moisture resistance.

XTE-30 comes in a standard range of sizes from .022" to 2" ID and even larger for special applications. Six contrasting colors simplify identification of leads and speed up complex wiring jobs. See for *yourself* what XTE-30 will do for you—just mail the coupon for free Technical Data Sheet.

Send this convenient coupon now

Irvington

VARNISH & INSULATOR COMPANY

Irvington 11, New Jersey

Plants: El Monte, California Hamilton, Ontario, Canada

EL-1-52

Irvington Varnish & Insulator Company
6E Argyle Terrace Irvington 11, N. J.

Gentlemen:

Please send me your Technical Data Sheet on IRV-O-LITE XTE-30 tubing.

Name.....Title.....

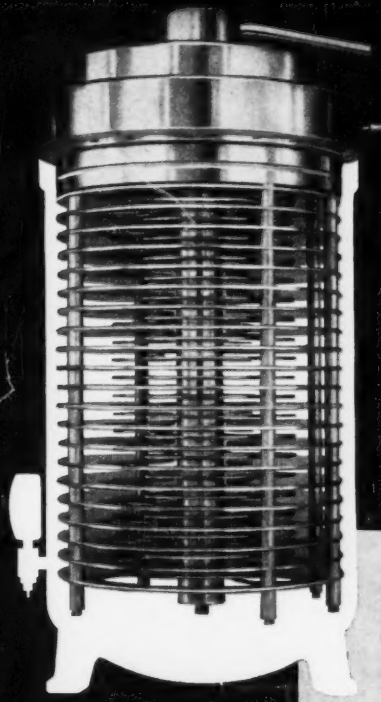
Company.....

Address.....

City.....State.....

For Further Information, Consult pages 92-93 in the 1951-1952 Electronics Buyers' Guide

IF IT'S SHEET METAL
FABRICATION . . . CALL ON
COLE
STEEL EQUIPMENT COMPANY
Tough assignments are part of our day's work. Whatever the product — instrument housings, boxes, chassis—we're geared to design, fabricate, and finish.
Years of experience and a superbly equipped plant give meaning to our statement: "If you have a sheet metal problem, we can solve it".
Inquiries Invited
manufacturers of the famous Cole steel office equipment
COLE
COLE STEEL EQUIPMENT CO.
285 Madison Ave., New York 17, N. Y.
Factory: York, Pa.



Lapp

GAS-FILLED CONDENSERS

More than 15 years service on thousands of Lapp Gas-Filled Condensers proves them to be completely reliable—electrically and mechanically. They offer the advantages of extreme compactness for high voltage and high current ratings... low loss... high safety factors... puncture-proof design... constant capacitance under temperature variation.

In construction, the condenser assembly is supported on a top aluminum ring, the steel tank serving only as a support for this ring and as a leak-proof gas container. The high potential plates are stationary, carried on a rigid aluminum center stud, supported by a ceramic bowl. Rotor plates are grounded, carried on ball-bearings in a race almost the full diameter of the tank. This construction provides a grounded tuning shaft on variable models, makes possible efficient and complete water cooling for high current operation, and results in direct and short current paths to condenser plates.

Write for complete description and specifications. Radio Specialties Division, Lapp Insulator Co., Inc., Le Roy, N. Y.

MODEL 11F
Fixed only

Capacitances up to 60,000 mmf.; 1 sec. current ratings: 175, 350, 525 amps.; Safety gap settings: 14, 25, 36 Kv peak.

MODEL 11B—*Fixed or Variable*
MODEL 11I—*Variable only*
MODEL 11IF—*Fixed only*

Capacitances up to 30,000 mmf.; 1 sec. current ratings: 120, 240, 360 amps.; Safety gap settings: 6, 14, 25, 36, 50, 63, 72 Kv peak.

MODEL 11S—*Fixed or Variable*
MODEL 11SF—*Fixed only*

Capacitances up to 15,000 mmf.; 1 sec. current ratings: 105, 210, 315 amps.; Safety gap settings: 6, 14, 25, 36, 50, 63 Kv peak.

MODEL 9R
Fixed or Variable

Capacitances up to 8000 mmf.; 1 sec. current ratings: 85, 170, 255 amps.; Safety gap settings: 6, 14, 25, 36, 50 Kv peak.

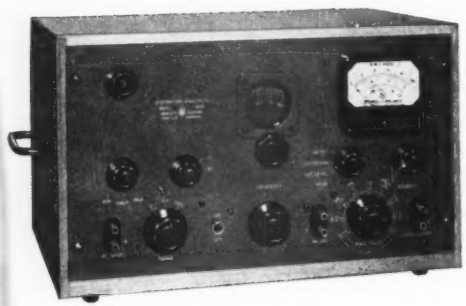
MODEL 7R
Fixed or Variable

Capacitances up to 8000 mmf.; 1 sec. current ratings: 70, 140, 210 amps.; Safety gap settings: 2½, 6, 14, 25, 36 Kv peak.

DISTORTION READINGS

Fast-operating *-hp-* analyzers give you accurate, dependable distortion and wave form measurements at appreciable savings in engineering time. *-hp-* instruments shown here provide complete coverage between 20 cps and 20 kc; they are basic equipment in laboratories, radio and television stations and on production lines everywhere. Each instrument has the traditional *-hp-* family characteristics of simple operation, minimum adjustment, independence of line voltage or tube changes, generous overload protection and sturdy construction from quality components. For complete information, see your *-hp-* field engineer, or write direct.

For TOTAL DISTORTION MEASUREMENTS



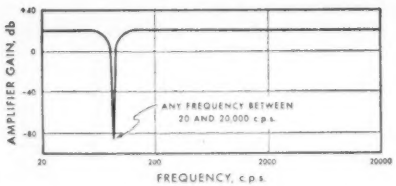


Figure 1. Rejection Characteristics, -hp- 330 series

-hp- 330B DISTORTION ANALYZER (left) is an unusually versatile instrument offering fast, accurate measurement of distortion values as low as 0.1% at any frequency between 20 cps and 20 kc. The equipment also quickly determines voltage level and power output, measures amplifier gain and response, measures audio noise and hum (direct readings), determines unknown audio frequencies and serves as a high-gain, wide-band, stabilized amplifier.

This equipment is actually three instruments in one. It includes a high-quality 20 db amplifier with less than 0.1% distortion, a tunable rejection filter offering almost infinite attenuation at any one frequency (see Figure 1), and a wide range, high sensitivity VTVM offering flat response from 10 cps to 100 kc. All of these elements are usable separately, and the amplifier may be cascaded with the VTVM to measure voltages as small as 100 μv.

For BROADCAST MEASUREMENTS

-hp- 330C DISTORTION ANALYZER, for FM measurements, is identical with *-hp-* 330B except that indicating meter movement has VU ballistic characteristics meeting F. C. C. requirements for FM broadcasting.

-hp- 330D DISTORTION ANALYZER is designed for both AM and FM measurements. It includes an AM detector to rectify AM carrier, plus meter movement having VU ballistic characteristics meeting F. C. C. requirements for FM.

HEWLETT-PACKARD COMPANY
2371 A PAGE MILL ROAD • PALO ALTO, CALIFORNIA, U.S.A.
FIELD ENGINEERS IN PRINCIPAL AREAS
Export: Frazar & Hansen, Ltd., San Francisco, New York, Los Angeles

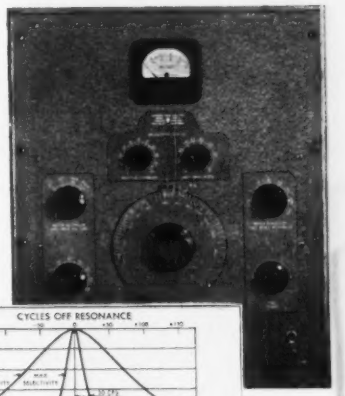
Complete Coverage

. . . . 20 cps to 20 kc

For MEASURING INDIVIDUAL WAVE COMPONENTS

-hp- 300A HARMONIC WAVE ANALYZER (right) is a selective voltmeter measuring the value of individual components of complex waves. Its variable selectivity is the key to its speed and versatility of operation. When wave components are close together, a unique selective amplifier can be narrowed to accept only desired components. When components are far apart, selectivity may be broadened to speed measuring without sacrificing accuracy. This feature is also important when measuring waves (such as in sound tracks) where some FM is present. The equipment is also ideal for analysis of noise, broadcast amplifier and network characteristics, recording devices, rotating machinery, hum and for all types of audio distortion measurements.

-hp- 300A is direct reading, covers the audio spectrum from 30 cps to 16,000 cps, and makes possible full-scale readings with inputs of 0.001 to 500 volts. Selectivity may be varied between limits shown in Fig. 2.



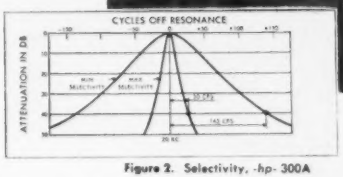


Figure 2. Selectivity, -hp- 300A

For TRANSIENT and FREQUENCY RESPONSE

-hp- 210A SQUARE WAVE GENERATOR provides a convenient, rapid method of determining transient and frequency response in a single measurement. It is widely used for testing receivers, video amplifiers, networks and transmitters; to measure time constants or provide a time base; to check cathode sweep circuits, indicate phase shift, transient effects or frequency response, to generate harmonics or control electronic switchers.

The 210A is an excellent, easy-to-use source of square waves for production line tests and laboratory use. High-quality square waves are generated over frequencies from 20 cps to 10 kc, and the equipment provides usable square waves up to 100 kc.

LOW COST DISTORTION ANALYZERS

-hp- 320A/B DISTORTION ANALYZERS are simple, low-cost devices for determining total harmonic distortion in audio frequency apparatus. They are particularly useful for high-speed production tests. *-hp-* 320A operates at two fixed frequencies: 400 and 5,000 cps. *-hp-* 320B operates at five fixed frequencies: 50, 100, 400, 1,000 and 5,000 cps. Both models require an external detector.

ANALYZER	PRIMARY USES	FREQUENCY RANGE	CHARACTERISTICS	PRICE
-hp- 300A	Wave form analysis.	30 cps to 16 kc	Variable selectivity, measuring range 1 mv to 500 v. 5% accuracy.	$625.00†
-hp- 320A	Measures total harmonic distortion at 2 fixed frequencies.	400 cps and 5 kc	Requires separate detector.	$75.00*
-hp- 320B	Measures total harmonic distortion at 6 fixed frequencies.	50, 100, 400 cps, 1, 5 and 7.5 kc	Same as above.	$150.00*
-hp- 330B	Measures total distortion, frequency tunable.	20 cps to 20 kc	Includes input amplifier and VTVM.	$395.00†
-hp- 330C	Similar to 330B. For FM broadcast measurements.	20 cps to 20 kc	VTVM has special characteristics to meet F.C.C. requirements.	$425.00†
-hp- 330D	Similar to 330B. For AM and FM broadcast measurements.	20 cps to 20 kc	Includes AM detector and special meter to meet F.C.C. requirements.	$440.00†
SQUARE WAVE GENERATOR				
-hp- 210A	For rapid determination of transient and frequency response.	20 cps to 10 kc	Output 50 v. peak to peak, 1,000 ohm impedance.	$150.00*

*Rack mounting available at $5.00 extra cost.
†Rack mounting available at no extra cost.
Data Subject to Change Without Notice. * Prices f.o.b. Palo Alto, California.

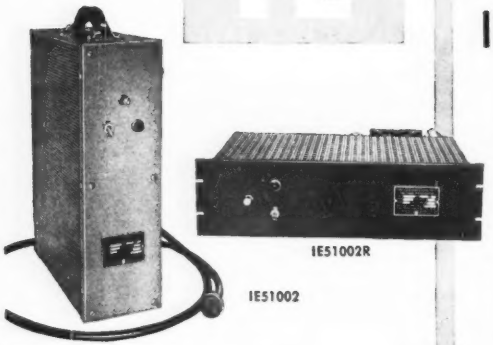
Complete Coverage

STABILINE

Automatic VOLTAGE REGULATORS

Two types of STABILINE Automatic Voltage Regulators are offered by The Superior Electric Company to meet the requirements of maintaining constant a-c voltage to electrical equipment.

IE



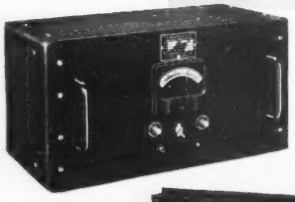
IE51002R

IE51002

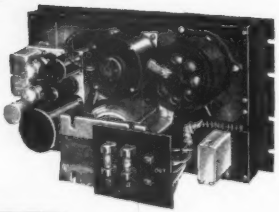
INSTANTANEOUS ELECTRONIC

Type IE is a completely electronic unit with no moving parts. It provides almost instantaneous correction of line voltage or load changes. Waveform distortion never exceeds 3 per cent. Output voltage is held to within ± 0.1 per cent of nominal for wide line variations; to within ± 0.15 per cent of nominal for any load current change or load power factor change from 0.5 lagging to 0.9 leading. Type IE is versatile in application finding wide use in laboratory work, on test lines and as a component of other equipment where the most exacting voltage regulation is necessary. There are 28 standard models for 115 and 230 volts, 50 or 60 cycles, single phase operation ranging in capacity from ¼ to 5 KVA. Special units are available for higher frequency operation . . . to meet government agency specifications . . . or for unusual applications.

EM



EM4102

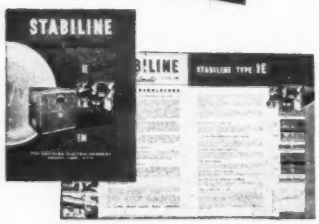


EM4102R

ELECTRO MECHANICAL

Type EM is an electro mechanical unit with a very sensitive detector controlling a motor-driven POWERSTAT variable transformer which feeds a buck-boost auxiliary transformer. Its outstanding advantages are zero waveform distortion and high efficiency. Type EM is most often used in the control of industrial loads. However; the demand of today's electronic equipment for constant voltage with absolutely zero waveform distortion necessitates the incorporation of a type EM as an integral part of the assembly. Type EM is offered in standard models for 115, 230 and 460 volts, 50 and 60 cycles, single and three phase duty in ratings from 2 to 100 KVA. Special units can be designed for higher frequencies, for conformance to government agency requirements and for individual needs.

FOR INFORMATION ON STANDARD STABILINE AUTOMATIC VOLTAGE REGULATORS SEND FOR BULLETIN S351 . . . COMPLETE WITH ENGINEERING DATA, PHOTOGRAPHS, RATINGS, DIMENSIONS AND DIAGRAMS.



THE SUPERIOR ELECTRIC CO.
BRISTOL, CONNECTICUT

201 THURE AVE, BRISTOL, CONNECTICUT

MANUFACTURERS OF POWERSTAT VARIABLE TRANSFORMERS, STABILINE AUTOMATIC VOLTAGE REGULATORS, VARICELL D-C POWER SUPPLIES, VOLTBOX A-C POWER SUPPLIES, SUPERIOR 5-WAY BINDING POSTS, POWERSTAT LIGHT DIMMING EQUIPMENT.

NEO-SIL CORPORATION

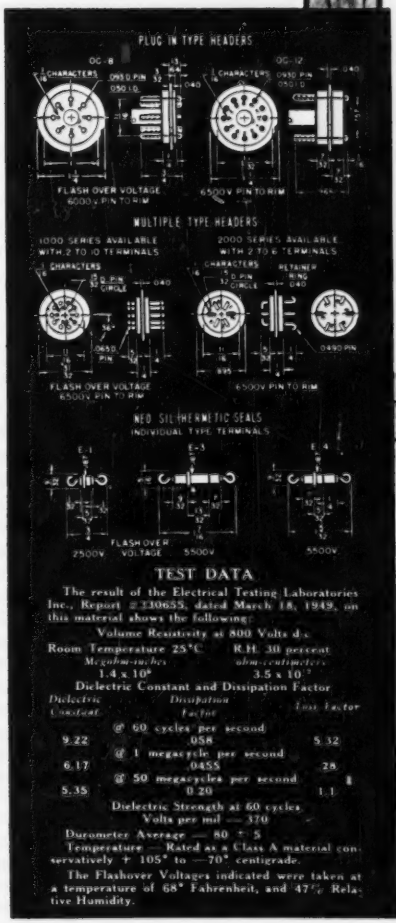
Master Pieces of Hermetic Sealing —Proven to Eliminate Rejects!

E3-LW TERMINAL

"E-Series terminals are applicable on MIL requirements and will withstand thermal shock, vibrations, mechanical strains, and excessive pressures with no impairment of the seal or other functional characteristics. E-3LW terminals are now being used at 1000 psi static oil pressure and undergo 5000 psi tests."

¼" SHAFT WATERSEAL BUSHING

"Rotary Waterseal Panel Assemblies, with GRAF-SIL Packing Glands, have an excellent five year customer history on gas filled pressurized components. They are available for ¼" shafts and for potentiometers and switch bushings."


PLUG IN TYPE HEADERS
FLASH OVER VOLTAGE 6000v PIN TO RIM
6500v PIN TO RIM
MULTIPLE TYPE HEADERS
1000 SERIES AVAILABLE WITH 2 TO 10 TERMINALS
2000 SERIES AVAILABLE WITH 2 TO 6 TERMINALS
FLASH OVER VOLTAGE 6500v PIN TO RIM
6500v PIN TO RIM
NEO-SIL HERMETIC SEALS
INDIVIDUAL TYPE TERMINALS
FLASH OVER VOLTAGE
2500v
5500v
5500v

TEST DATA

The result of the Electrical Testing Laboratories Inc., Report #230655, dated March 18, 1949, on this material shows the following:

Volume Resistivity at 800 Volts d.c.

Room Temperature 25°C	R.H. 30 percent
Megohm-inches	*ohm-centimeters*
1.4×10^5	3.5×10^5

Dielectric Constant and Dissipation Factor

Dielectric Constant	*Dissipation Factor*	*Loss Factor*
@ 60 cycles per second		
9.22	.058	5.32
@ 1 megacycle per second		
6.17	.0455	.28
@ 50 megacycles per second		
5.35	0.20	1.1

Dielectric Strength at 60 cycles
Volts per mil — 370

Durometer Average — 80 ± 5

Temperature — Rated as a Class A material conservatively + 105° to —70° centigrade.

The Flashover Voltages indicated were taken at a temperature of 68° Fahrenheit, and 47% Relative Humidity.

"NEO-SIL's proven Hermetic sealing components will eliminate rejects resulting from breakage, strains, cracks, etc. Each NEO-SIL component is pressure checked at 25 psi — to meet military requirements and as applied to our units, NEO-SIL rubber will resist abusive temperature cycling, salt water, most acids and alkalies, and withstand high pressures and vacuums."

"In addition to the items illustrated above, NEO-SIL offers many other components, such as Hermetically Sealed Fuse Holders, Octal Type Plug In Headers, Multiple Pin Headers, Hermetically Sealed Cables, Hermetically Sealed Line Cords With Plugs For European use, Meter Gaskets, Panel Gaskets, Adapters (U.S. to Continental), Coil Forms, Crystal Contacts and other molded bakelite and NEO-SIL rubber units."

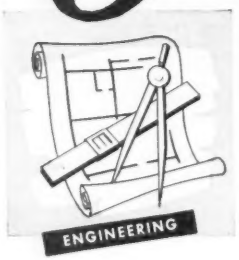
"Hermetically Sealed Fuse Holders are available for 3-AG and 4-AG fuses. These units are completely sealed from moisture with or without the cap or fuse inserted and are applicable for use on vacuum or gas filled units."

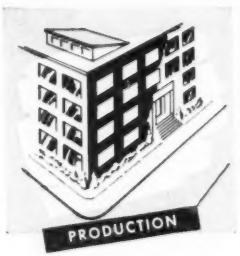
Your special problems are solicited.

NEO-SIL CORPORATION

26 CORNELISON AVE., JERSEY CITY 4, N. J.

LABORATORY for ELECTRONICS, INC.



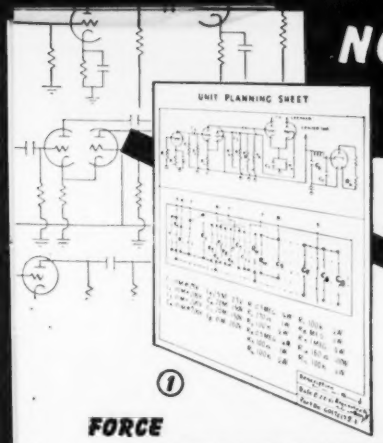


Founded in 1946, Laboratory for Electronics has grown ever since in size, experience and creative ability. As prime contractors for the United States Government on important classified projects, the company pioneered in the development of many new and advanced electronic devices. Soon Electronic Equipment will be ready for commercial distribution . . . research and engineering have been underway for years . . . production has now started. Look for Laboratory for Electronics advertising on your desk and Laboratory for Electronics salesmen at your door. The news they bring to you will be interesting and important.

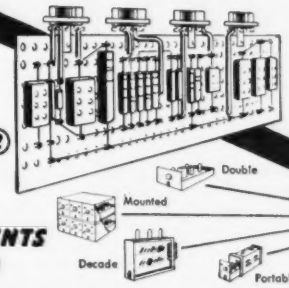
LABORATORY for ELECTRONICS, INC.

43 LEON STREET BOSTON 15, MASS.

NOW YOU CAN MOVE FROM IDEA TO EQUIPMENT FAST

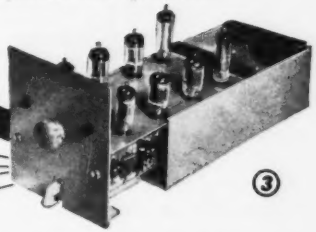


TERMINAL MOUNTING CARDS ORGANIZE CIRCUITS QUICKLY



ALDEN BASIC CHASSIS

Easily fabricated sub-assemblies built into equipment that has utmost ease of service and operation.



FORCE STRAIGHT-LINE THINKING WITH NEW ALDEN COMPONENTS FOR PLUG-IN CONSTRUCTION

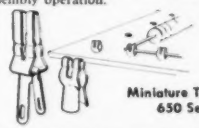
To design Electronic Equipment that must be produced quickly and in quantity, make your model with Alden Basic Chassis and "20" Packages. Save vital engineering and planning time — machine and tool hours — critical material and manhours.

① ORGANIZE CIRCUITS QUICKLY FOR SYSTEMATIC LAYOUT AND CONSTRUCTION

Schematics of most all electronic equipment can be broken down into circuit blocks of logically associated functions. These functional circuit blocks can be mounted readily either in the Alden "20" plug-in packages or Basic Chassis unit. The tube sockets and associated components lay out quickly on full scale Unit Planning Sheets for mounting on terminal cards. These special pre-punched, multi-hole terminal cards have wide flexibility to take an infinite variety of circuit variations. Both sides of card can be used to obtain maximum component density area. Using the Unit Planning Sheets, functional circuit units — components and housings — are all planned in one step.

② GET THE MOST NATURAL, EASY SUB-DIVISION OF LABOR IN MANUFACTURE

Solder terminals and sockets quickly rivet to Alden terminal card according to layout on Unit Planning Sheet. Components snap into the special **Alden Miniature Terminals** which hold them for soldering. — (No twisting or wrapping of leads necessary.) — With all tube sockets and their associated components mounted on one card — the wiring and soldering of circuits is an open, easy-to-work sub-assembly operation.



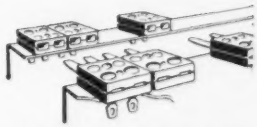
Miniature Terminals 650 Series

Terminal cards have been designed to accommodate tremendous number of circuit variations — to make neat tube and component sub-assemblies with a minimum of wiring.

③ INSURE THE LOWEST OPERATING AND SERVICE COSTS IN FINAL EQUIPMENT

The ALDEN BASIC CHASSIS UNIT is rapidly completed by mounting terminal cards into the chassis — soldering unit cables and making connections to **Alden Color Coded Back Connectors** and detachable front panel. Completed unit is easily piloted in and out of rack with the Serve-A-Unit Lock. Open sided construction, aided by the neat direct front and back connections, gives instant accessibility for rapid circuit checks and service.

Alden Terminal Card System means minimum of intercabling — but even this cabling can be laid out easily and proceed as simple sub-assembly. Open sided chassis construction makes cable easy to wire to front panel, terminal cards and back connectors.



Back Connectors — 462 Min Series

The **Alden Back Connectors** are units that can be discretely positioned on the back of the chassis — isolating lines with incompatible voltages, currents, or frequencies. This design insures accessible solder terminals for soldering — avoids rat nests of congested conventional back connector wiring. — Color coded, the Alden back connectors provide beautiful operational or service check points for all leads to and from chassis.

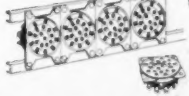
Hinged front panel design of chassis — allows rheostats, indicator lights, jacks, etc. to be mounted on panel as another easy-to-work sub-assembly. This panel attaches easily to chassis — is wired — swung up and fastened with Alden Target Screws.

Assembled — Basic Chassis simplifies the operation of your equipment — Slashes service and maintenance time. Smooth, positive insertion and removal of the chassis is provided by the Alden "Serve-A-Unit Lock"

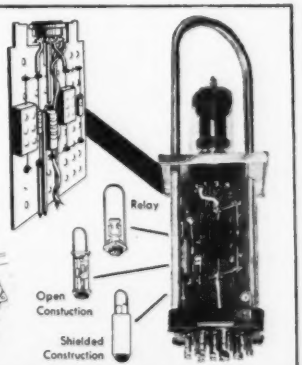
For Smaller Units Alden "20" Plug-in Packages

Here is a plug-in package unit using the above method of converting schematic into finished assembly quickly. Simply mount the completed terminal card sub-assembly on the Alden "20" Non-Interchangeable base, dip soldering the leads and adding cover or housing and handle . . . In operation, visual or instrument checks are easily made — if trouble occurs doubtful units are quickly isolated — these units easily unplug and a comprehensive inspection made. Spare units can be plugged in so equipment doesn t have to be inoperable while repairs are in process.

"20" Non-Interchangeable Base



"20" Rack and Chassis Mounting Sockets



TO GET STARTED QUICKLY! **'phone our New Products Director for an appointment to visit our plant — Wire for a sample Basic Chassis at $40.00 or an Open and Closed Alden "20" Plug-in Package at $10.00 — or write Dept. E for Booklet: "Basic Chassis and Components for Plug-in Unit Construction".**

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For visual observation of pulses and single transients, the Type 294-A Cathode-ray Oscillograph provides high light-output and wide-band response. For careful study and permanent reference of these signals the Type 295 Oscillograph-record Camera records writing rates as high as 35 inches per microsecond.

TYPE 295 high-speed, single-frame OSCILLOGRAPH-RECORD CAMERA **$550.00**

TYPE 294-A high-voltage, high-frequency CATHODE-RAY OSCILLOGRAPH **$1320.00**

PULSE RESPONSE FREQUENCY RESPONSE SENSITIVITY

This oscillogram illustrates the double exposure technique. Binocular viewing in the Type 295 facilitates proper positioning for close comparison.

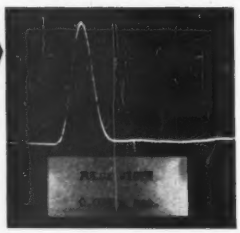
The pulses in the oscillogram at left are identical pulses of 0.25 microsecond width. The first pulse was applied through the Y-axis amplifier of the Type 294-A, and the second, directly to the vertical deflection plates. A comparison of their waveforms illustrates the excellent transient response of the Y-axis of the Type 294-A.

Response of the Y-axis amplifier to a rise time of 0.01 microsecond or less is 0.03 microseconds max. Notice that a minimum of overshoot (less than 2%) is introduced by the amplifier.

For the study of sinusoidal frequencies, the response of the Type 294-A extends from 10 cps. to 12 megacycles (down 30%). Sensitivity of the Y-axis, through the amplifier, is 0.42 peak-to-peak volts per inch.

AVAILABLE DEFLECTION LIGHT OUTPUT SIGNAL DELAY

"Time" and "Bulb" exposures may be taken with the Type 295. And provision is made so that equipment may be triggered simultaneously with shutter opening. With appropriate accelerating potentials, the Type 295 is capable of recording single transients in excess of 280 inches per microsecond.

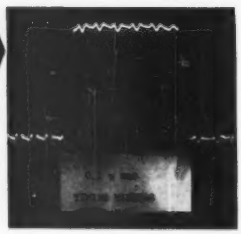


The Type 294-A provides undistorted vertical deflection of 1.3 inches or more for both positive and negative pulses; and 2.75 inches for symmetrical signals. The high light-output of the Type 294-A increases the value of the large, vertical deflection provided by the Y-axis amplifier. This is illustrated by the high visibility of the rise and decay of the pulse shown at left. Here, the Type 5XP— Cathode-ray Tube of the Type 294-A was operated at 12 kv. However, where maximum light output is not required, the accelerating potential may be lowered to 7 kv by means of a switch. At this level of operation, of course, the available undistorted deflection is increased.

To insure the complete display of fast pulses such as those at left, the Y-axis includes a 0.25 microsecond signal-delay line.

SWEEP SPEEDS TIME CALIBRATION

The built-in illuminated datacard of the Type 295 will prove invaluable when making time measurements. A film take-up cassette is arranged so that exposed frames of film may be separated from unexposed film and taken to the darkroom for immediate developing.



Complementing the Y-axis performance of the Type 294-A, sweep durations are continuously variable from 0.1 second to 3 microseconds. By increasing the length of the sweep, speeds greater than 0.25 microsecond per inch may be obtained, thus providing more detail to facilitate the study of short-duration pulses.

Calibration of the sweeps of the Type 294-A is accomplished with vertical marks occurring at intervals of 100, 10, 1, or 0.1 microseconds. In the oscillogram at left, the 0.1 microsecond markers appear mixed with the signal on the vertical axis. Time measurements may also be made by double exposure of first, the signal, and second, the timing markers.

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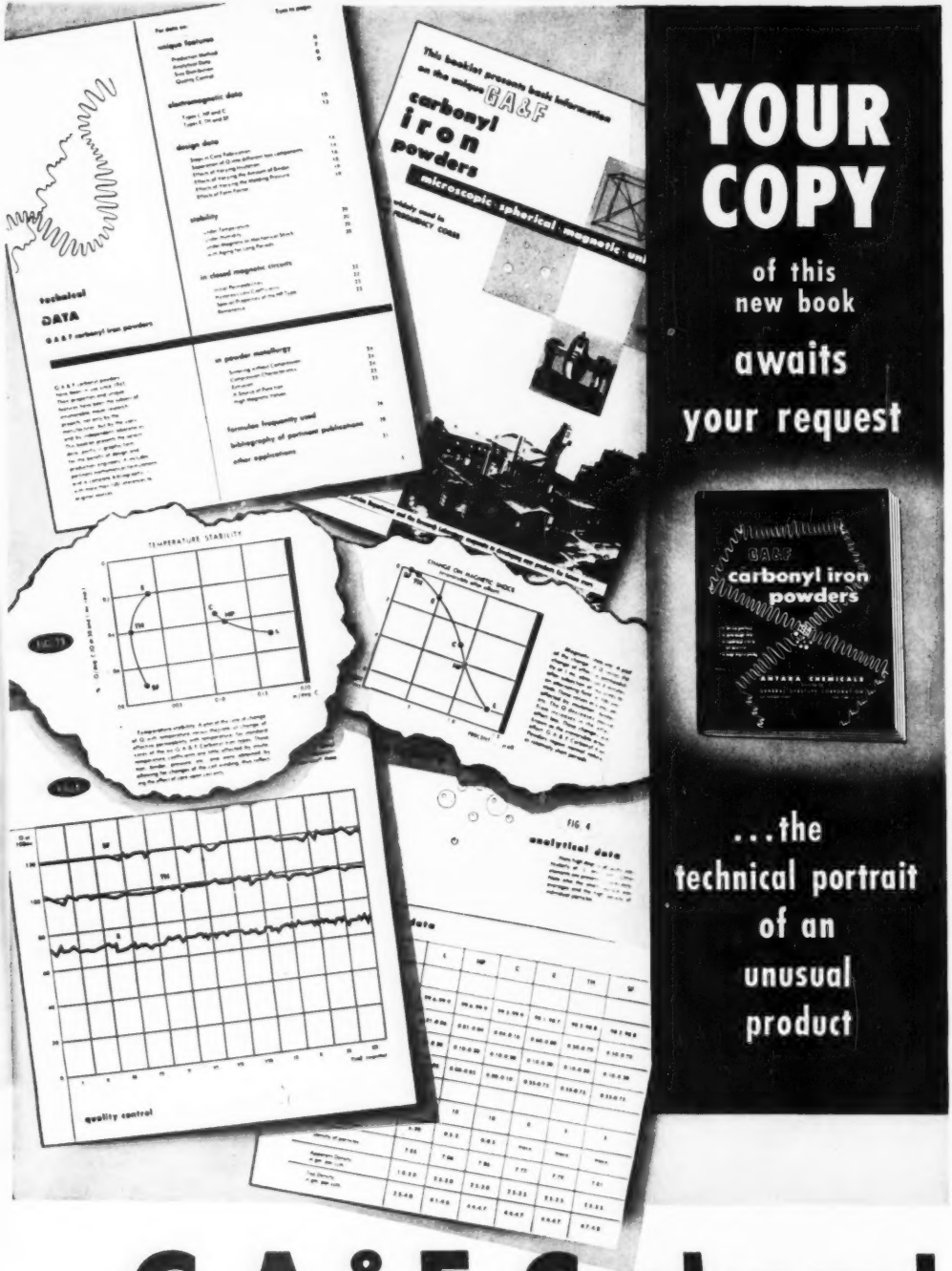

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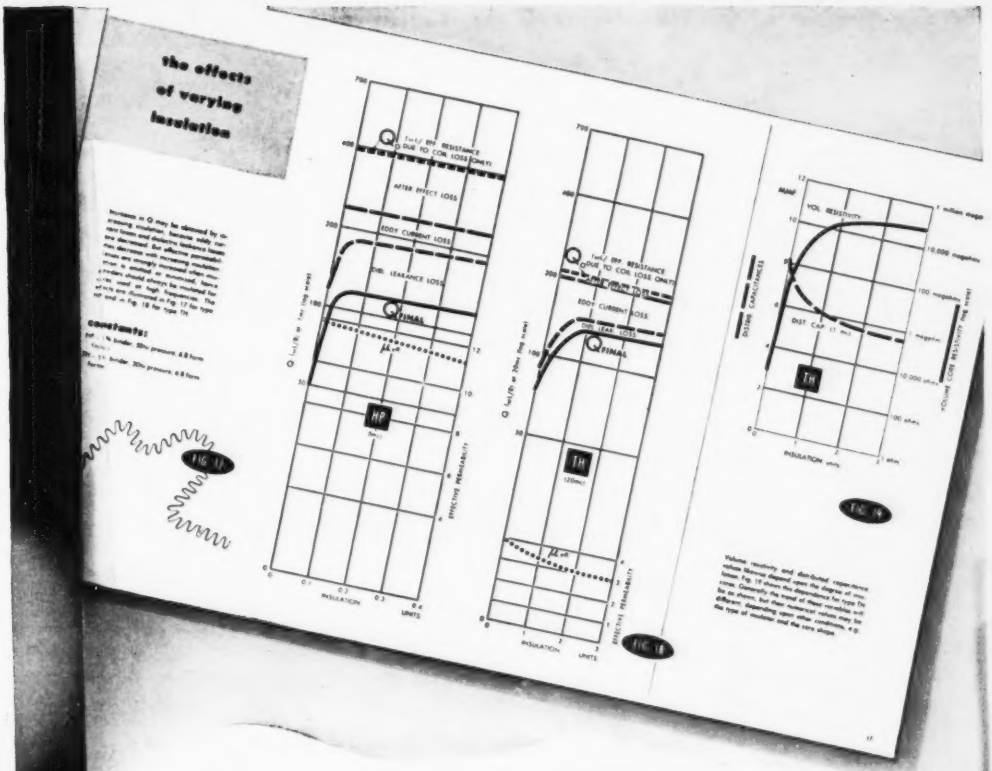

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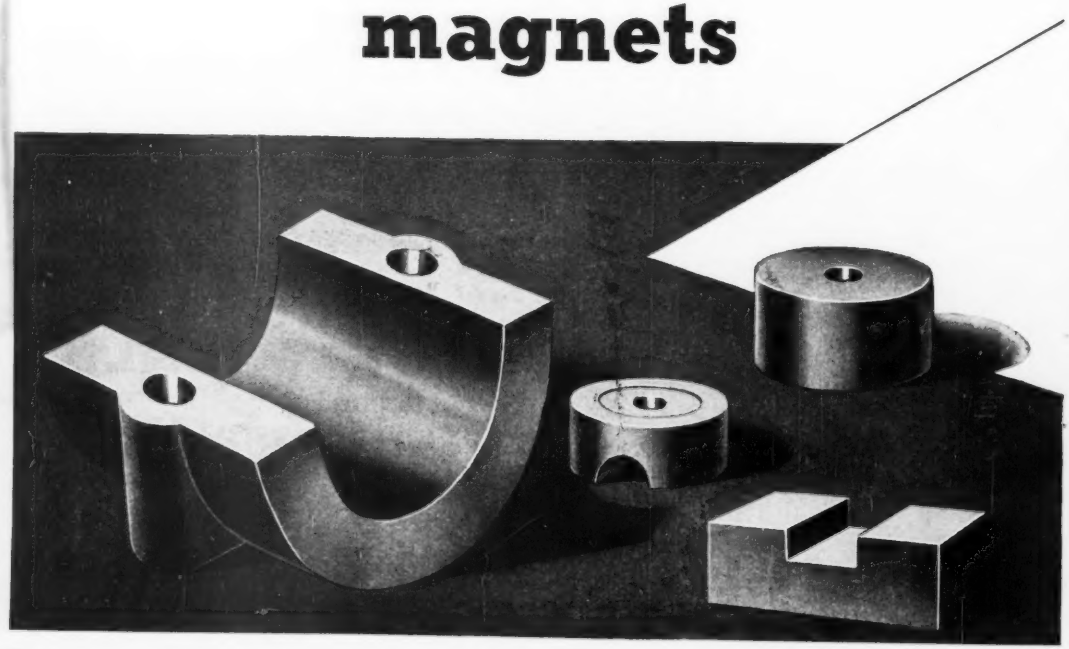

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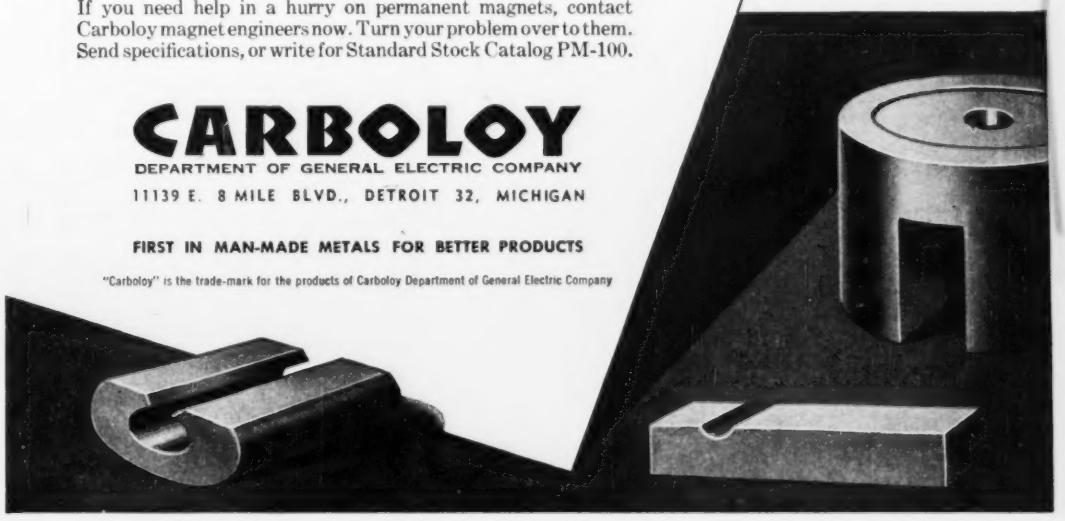

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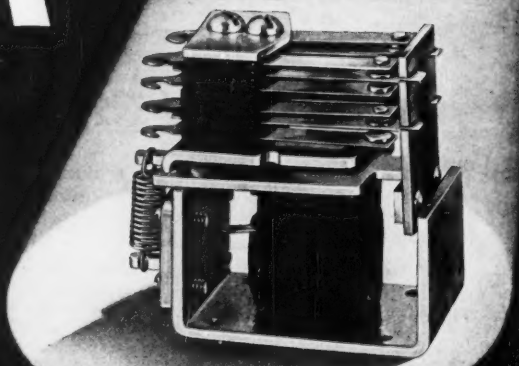

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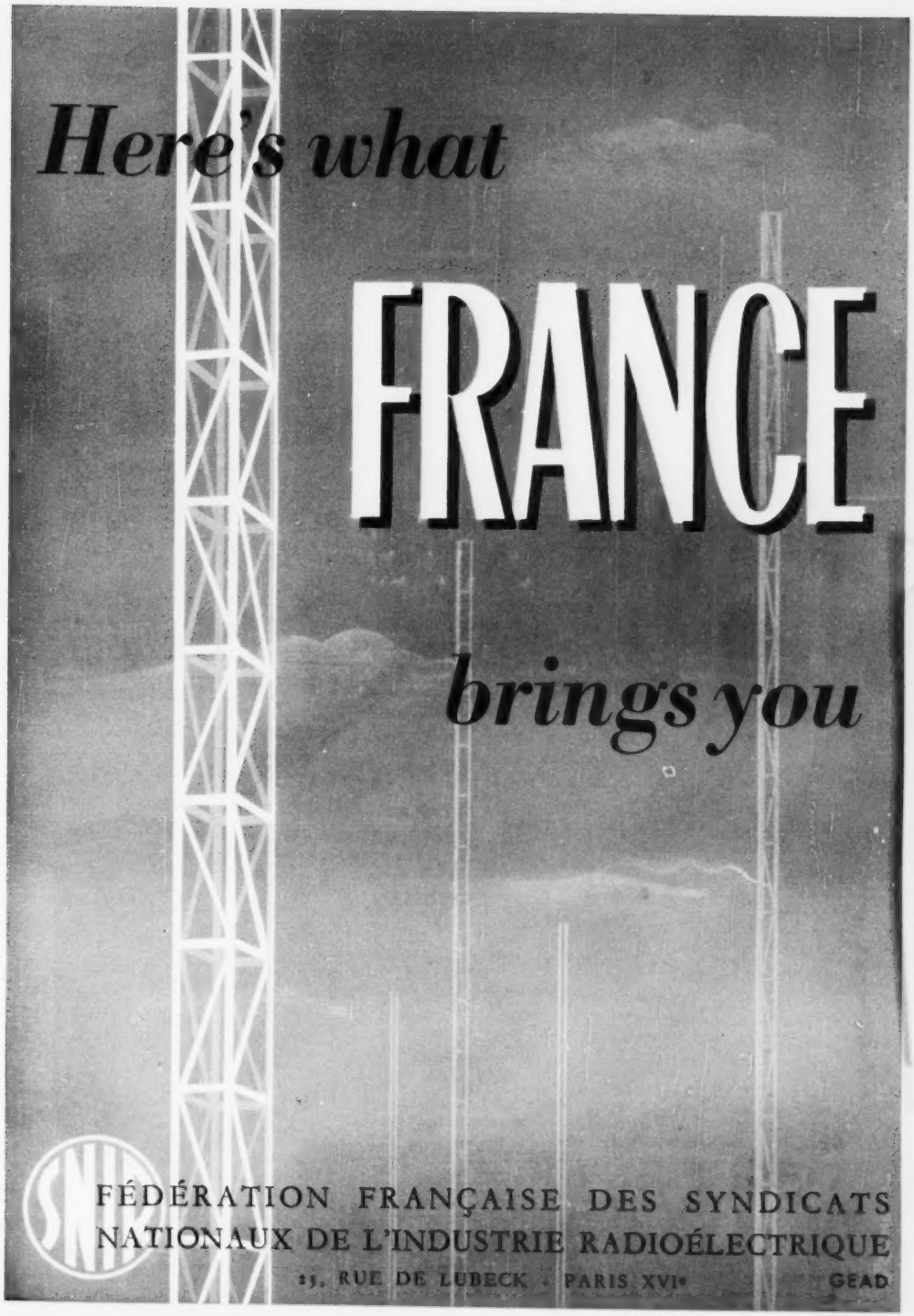
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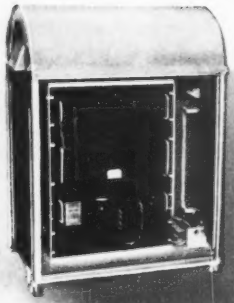

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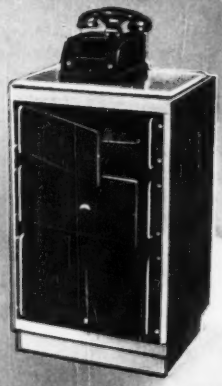

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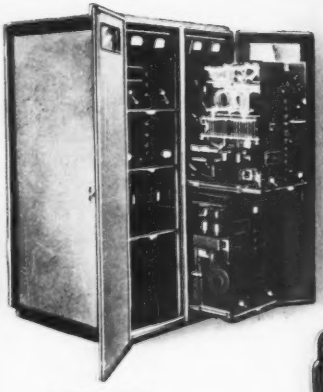

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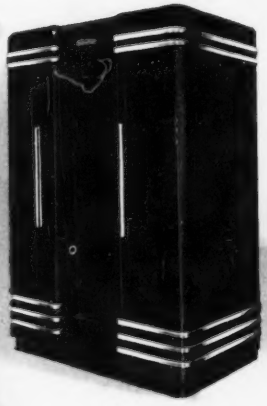

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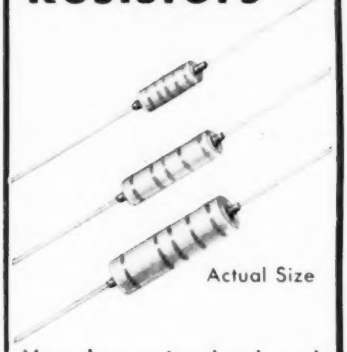

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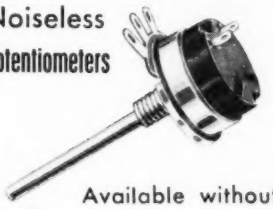

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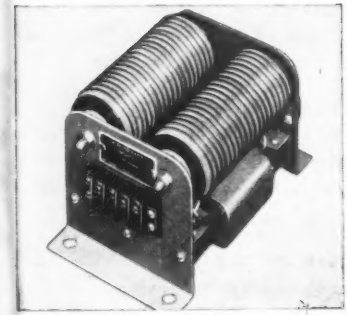

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As part of a continuing effort to better serve the electronics industry, General Electric has recently enlarged its line of amplistats (self-saturating magnetic amplifiers). These remarkable units, for amplifying small d-c signals from relatively low-impedance sources, can be profitably applied to many control and instrumentation circuits both in conjunction with, and in place of, electronic equipment.

At present, G-E amplistats are available in three component ratings and one "educational" or laboratory research device. G-E engineers will be glad to aid and advise in developing complete amplification systems around these products.

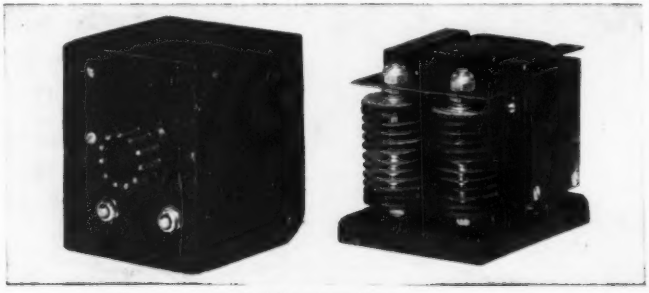
1-VA AMPLISTAT is easy to connect and remove because it's mounted on a standard tube-type base. Maximum power gain is over 2000 watts per watt. Response time is $\frac{1}{3}$ sec or less. Operates directly on 40-volt, 60-cycle a-c. Dimensions, 2 x 2 x $2\frac{5}{8}$ in. high including octal base. Weight, 11 oz. Further details in Bulletin GEC-784.

40-VA MODEL has selenium rectifiers and four separate control windings. Maximum power gain is 15,000 w/w. Response time is 2 sec, corresponding to maximum-gain conditions. No special power supply—operates directly on 115-volt, a-c. Dimensions, 5 x $7\frac{3}{4}$ x $4\frac{5}{8}$ in. Weight 7 lb. See Bulletin GEC-790.

400-CYCLE UNITS are push-pull output, d-c linear amplifiers with three separate d-c input windings. Designed as the first and second stages for thermocouple signal amplifiers meeting aircraft requirements, they're also applicable to many other amplification problems.

Available for power supplies rated 15 or 30 volts, they have a maximum power gain of 2050 w/w. Response time ranges from 0.0036 to 0.0177 sec. Output ratings, 20 to 30 milliamp. Dimensions, $3\frac{3}{32}$ x $2\frac{9}{16}$ x $2\frac{3}{4}$ in. Weight, 14 oz. For further information write to *Special Products Sales, General Electric Company, Schenectady 5, N. Y.*

"EDUCATIONAL" AMPLISTAT is useful in laboratories for experimental work and for studying new circuits. Operates directly from 115-volt, 60-cycle power. Gain is up to 25,000 watts per watt. Output is 1.0 amp continuous. Get more details in Bulletin GEC-599.

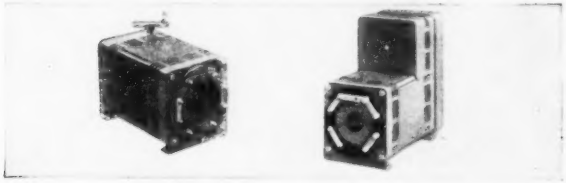


400-cycle amplistat

DIGEST

TIMELY HIGHLIGHTS ON G-E COMPONENTS

HOLD VOLTAGE STEADY—OR ADJUST IT PRECISELY—WITH G-E INDUCTROLS



For precise and dependable stepless voltage regulation or variation it's G-E inductrols. These single-phase units are available in ratings from 3 to 240 kva for circuits 600 volts and below. Motor-operated units, used with automatic control, maintain voltage within narrow limits regardless of line-voltage variation. Hand-operated models provide smooth and precise voltage adjustment for instrument calibration, rectifier control, and similar uses. Check Bulletin GEC-795.

G-E SELSYNS INDICATE POSITION—CONTROL MOTION

G-E selsyn transmitters and receivers provide automatically synchronized indication or control at one location with respect to an initial remote reference point. Built for accurate, economical, continuous service, they can be used to indicate angular or linear movement, or to control the motion of a device by controlling its actuating element. Two types are available—general purpose, for accuracy within ±5 deg; and high accuracy, ±1 deg. See Bulletin GEA-2176.

CONTROL WIRING SIMPLIFIED WITH G-E TERMINAL BOARDS

You get positive electrical connections without soldering using G-E Type EB-6 terminal boards fabricated from strong, durable molded Textolite* parts. To facilitate marking, reversible marking strips are white on one side, black on the other. Boards have 4 to 12 poles. Rated 30 amp, 600 volts. Complete details are contained in Bulletin GEA-1497.

Reg. Trade-mark of General Electric Co.

EQUIPMENT FOR ELECTRONIC MANUFACTURERS

A partial list of the thousands of items in the complete G-E line. We'll tell you about them each month on these pages.

Components

Meters and instruments	Timers
Capacitors	Indicating lights
Transformers	Control switches
Pulse-forming networks	Generators
Delay lines	Selsyns
Reactors	Relays
*Thyrite	Amplidynes
Motor-generator sets	Amplistats
Inductrols	Terminal boards
Resistors	Push buttons
Voltage stabilizers	Photovoltaic cells
Fractional-hp motors	Glass bushings
Rectifiers	Dynamotors

Development and Production Equipment

Soldering irons
Resistance-welding control
Current-limited high-potential tester
Insulation testers
Vacuum-tube voltmeter
Photoelectric recorders
Demagnetizers

General Electric Company, Section A667-18
Schenectady 5, N. Y.

Please send me the following bulletins:

Indicate: √ for reference only
× for planning an immediate project

( )	GEA-1497	Fabricated Terminal Boards
( )	GEA-2176	Selsyns
( )	GEC-599	Educational Amplistat
( )	GEC-784	One-Volt-Ampere Amplistat
( )	GEC-790	Forty-Volt-Ampere Amplistat
( )	GEC-795	Single-Phase Inductrols

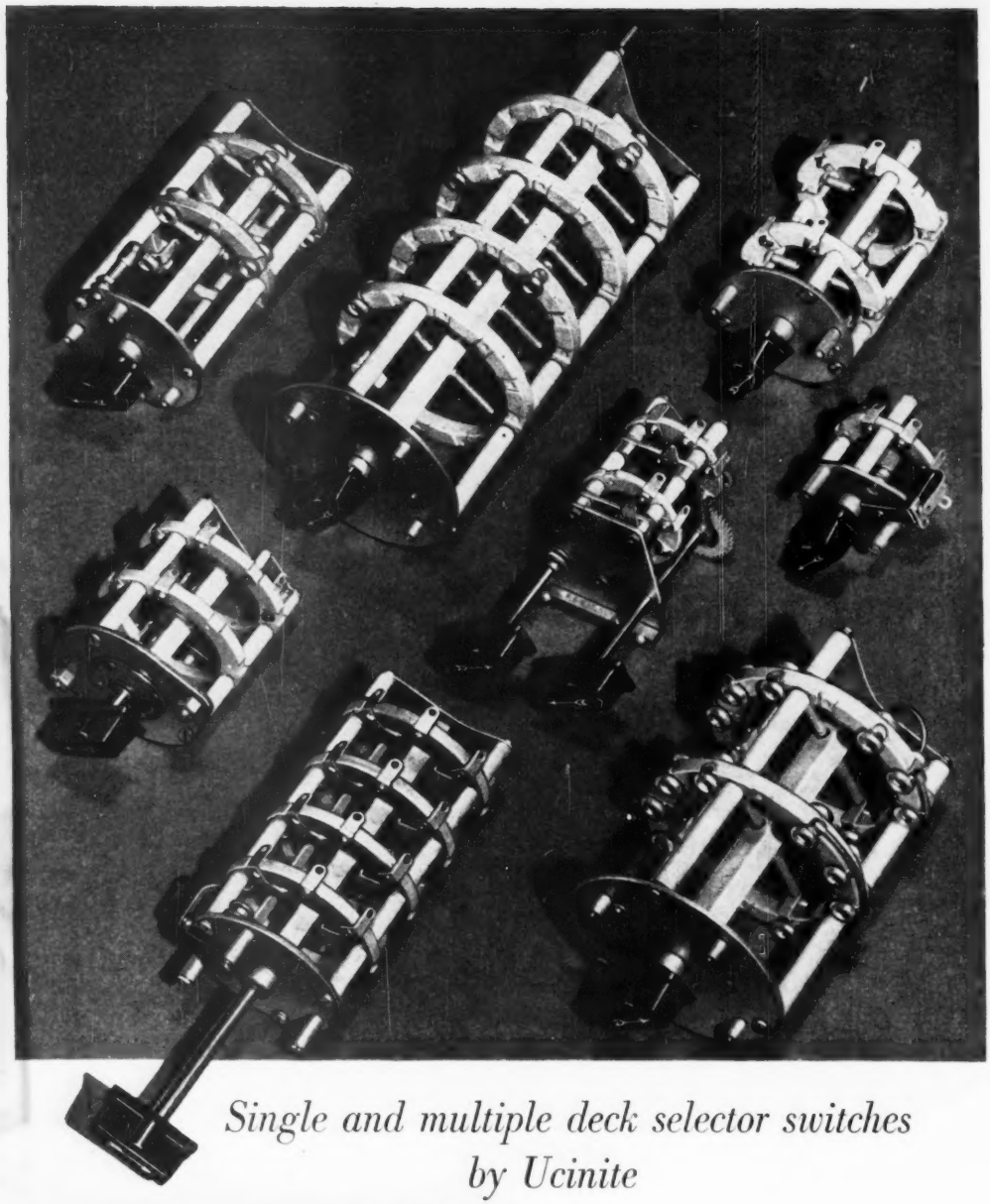
Name .....

Company .....

Address .....

City ..... State .....

GENERAL ELECTRIC



Single and multiple deck selector switches by Ucinite

The UCINITE CO.

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Specialists in

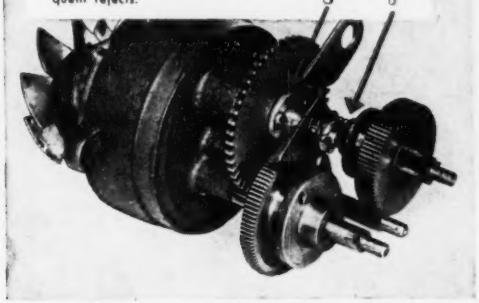
ELECTRICAL ASSEMBLIES,

RADIO AND AUTOMOTIVE

2 WALDES TRUARC RINGS
REPLACE COTTER PINS AND WASHERS...
SAVE $.0219 PER UNIT

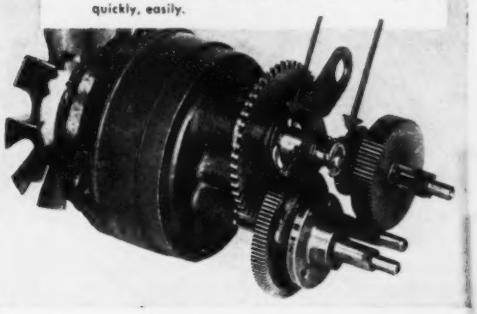
OLD WAY

Cam shaft for breathing roll ironer mechanism required: drilling 2 holes; 2 cotter pins; 2 washers. Inaccuracy in locating holes for cotter pins caused frequent rejects.



NEW WAY

2 simple grooves to accommodate 2 Waldes Truarc Rings, are cut in shaft during regular screw machine cycle—at no extra cost. Waldes Truarc Rings are applied quickly, easily.



Using 2 Waldes Truarc "E" Retaining Rings in their Automatic Cabinet Ironer, saved The Horton Manufacturing Co., Fort Wayne, Ind., $.0219 per unit. Truarc Rings saved 50% in assembly time... cut down on rejects... increased efficiency of the unit... eliminated risk of damage to hands and clothing of workers in assembly.

Redesign with Truarc Rings and you, too, will cut costs. Wherever you use machined shoulders, bolts, snap rings, cotter pins, there's a Waldes Truarc Retaining Ring designed to do a better job of holding parts together.

Truarc Rings are precision-engineered... quick and easy to assemble and disassemble. Remain circular to give a never-failing grip. They can be used over and over again.

Find out what Truarc Rings can do for you. Send your blueprints to Waldes Truarc engineers for individual attention, without obligation.

COMPARATIVE COSTS—

WITH COTTER PINS		WITH TRUARC RINGS	
MATERIAL:		MATERIAL:	
2 washers	.0045		
2 cotter pins	.0017	2 Truarc E Rings	.0283
OPERATIONS:		OPERATIONS:	
drilling 2 holes in shaft	.0223	Cutting 2 grooves	.0000*
ASSEMBLY TIME	.0485	ASSEMBLY TIME	.0268
Total cost	$.0770		$.0551

TOTAL SAVINGS WITH TRUARC RINGS $.0219 PER UNIT

*Grooves are cut in shaft during regular screw machine cycle

For precision internal grooving and undercutting... Waldes Grooving Tool.

SEND FOR NEW BULLETINS ➡

WALDES

TRUARC

REG. U.S. PAT. OFF

RETAINING RINGS

WALDES KOHINOOR, INC., LONG ISLAND CITY 1, NEW YORK

WALDES TRUARC RETAINING RINGS AND PLIERS ARE PROTECTED BY ONE OR MORE OF THE FOLLOWING U.S. PATENTS: 2,382,947; 2,382,948; 2,410,852; 2,420,931; 2,438,341; 2,439,789; 2,441,848; 2,458,169; 2,483,380; 2,483,383; 2,487,803; 2,487,803; 2,491,308; 2,508,081 AND OTHER PATENTS PENDING

Waldes Kohinoor, Inc., 47-16 Austel Place, L. I. C. 1, N. Y.

Please send engineering specifications and data on Waldes Truarc Retaining Ring types checked below. E-014

- ☐ Bulletin #5 Self-locking ring types
- ☐ Bulletin #6 Ring types for taking up end-play
- ☐ Bulletin #7 Ring types for radial assembly
- ☐ Bulletin #8 Basic type rings
- ☐ Send me information about the Waldes Grooving Tool.

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the truth about Dow Corning Silicones...

. . . is more fantastic than the patter of the pitchman or the spiel of the barkers that doubled in advertising and sales a generation ago. For example:

- Silicone (Class H) electrical insulation makes motors and other kinds of electrical equipment last 10 times as long as they ever did before.
- These same insulating materials are used to double the power per pound ratio in electric machines.
- Silastic,* the Dow Corning silicone rubber is used to seal hot air at 600°F., hot oil at 350-400°F., limit switches and bomb bay doors at −100°F.
- Dow Corning Silicone oils and greases make permanent lubrication a practical reality.

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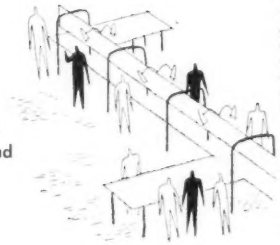

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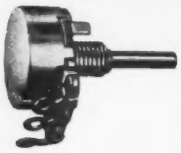
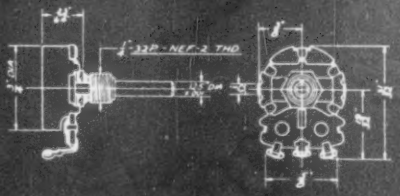
Highly recommended for use in jet and other planes, guided missiles, tanks, ships and submarines, portable or mobile equipment and all other military communications. Manufactured from specially developed materials, these absolutely unique variable resistors are now available in a complete range of sizes. (See chart at bottom of page.)

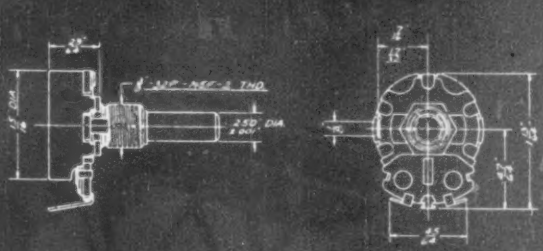


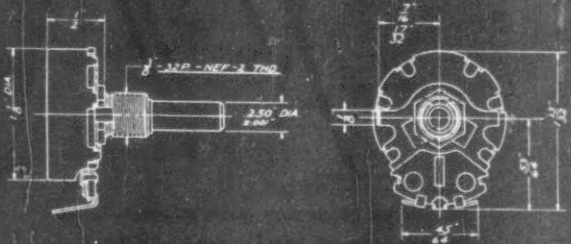
Type 65

Type 90

Type 95





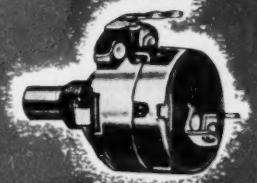


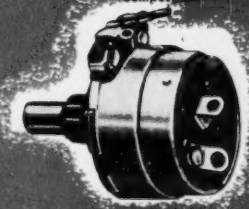
+150°C to −55°C

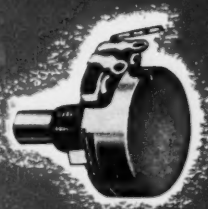
	TYPE 95 1⅛"	TYPE 90 1¹⁵⁄₁₆"	TYPE 65 (miniaturized) ⅞"
Wattage and Voltage Rating	2 watts @ 70°C with 500 V max. across end terminals	1 watt @ 70°C with 350 V max. across end terminals	½ watt @ 70°C with 250 V max. across end terminals

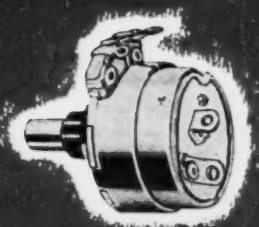
Specialists in Precision Mass Production of Variable Resistors

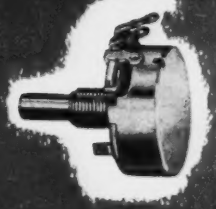
Meets Military Specifications



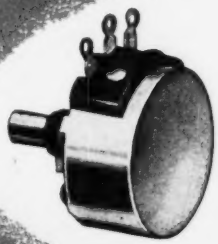




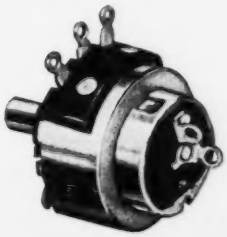




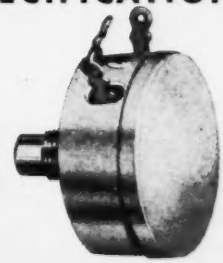
MEETS ALL JAN-R-19 SPECIFICATIONS



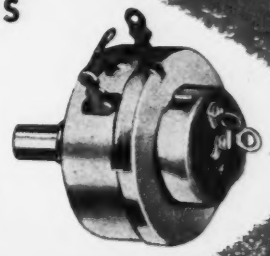
JAN Type RA 20A
2 Watt (CTS Type 252)



JAN Type RA 20B
2 Watt (CTS Type GC-252)



JAN Type RA 25A or 30A
3 or 4 Watt (CTS Type 25)



JAN Type RA 25B or [illegible]
3 or 4 Watt (CTS Type [illegible])

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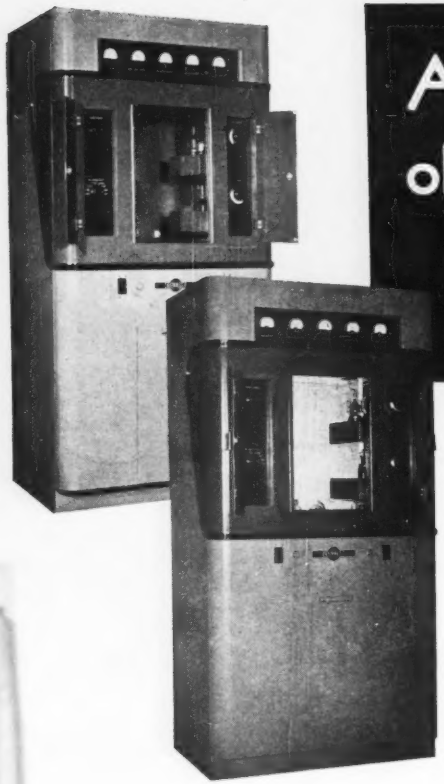

A triumph in the art of transmitter design..

made possible through the use of Eimac tetrodes.

Collins 300J 250-watt and 20V 1kw AM broadcast transmitters employing Eimac 4-125A and 4-250A power tetrodes.

In your own equipment . . . enjoy the advantages and economies made possible through the use of Eimac tetrodes. Write our Application Engineering Department for the latest information and technical data.

The Collins 300J 250-watt and 20V 1kw AM broadcast transmitters are a tribute to the art of transmitter design. Performance, circuit simplicity and economy of operation highlight the many features Collins Radio has incorporated in these modern transmitters.

Through the use of high-gain, long-life Eimac tetrodes, Collins has achieved considerable simplification in circuits associated with the modulator and power amplifier stages. These highly efficient tetrodes also permit the use of low drain receiver-type tubes in the driver stages. Spare tube inventory can be kept small and representing a minimum investment. As an example; the 300J employs only 16 tubes of but 7 types in the entire transmitter.

Follow the Leaders to Eimac TUBES The Power for R-F

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San Bruno, California
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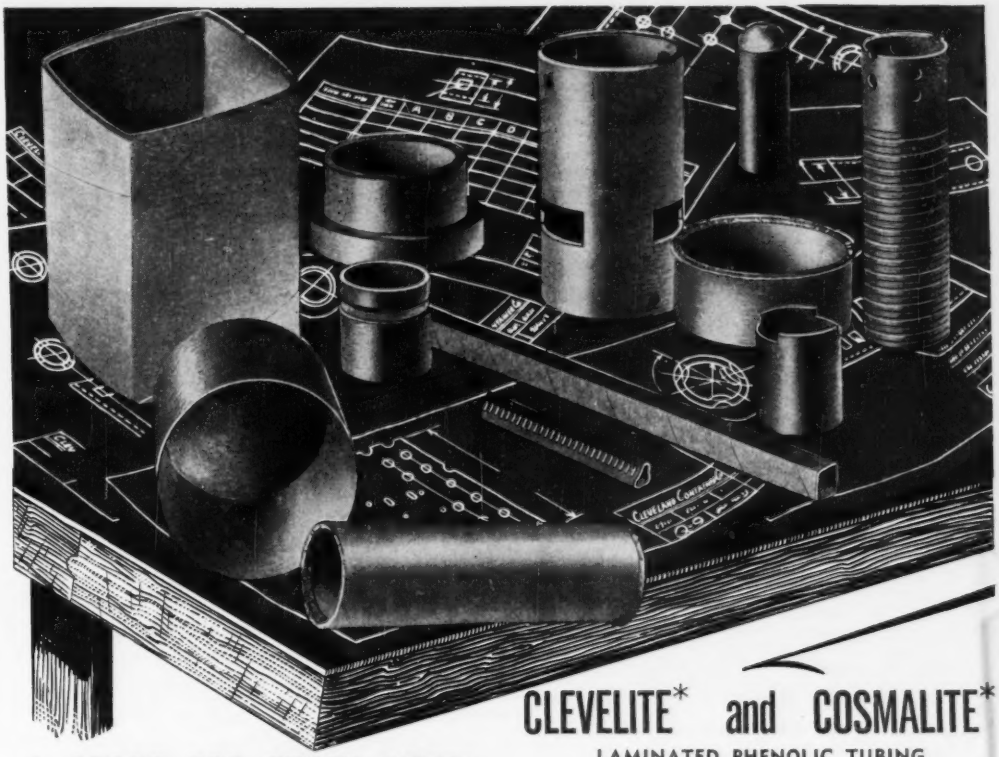

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. . . meets the most exacting requirements of the electronic and electrical industries!

Whether to insulate the live electrical parts of a rectifier, a high voltage transformer, or any one of countless other applications . . . satisfaction is ensured.

For wherever physical strength, low moisture absorption, high dielectric strength, low loss and good machineability are of prime importance . . . the combined electrical and physical properties of CLEVELITE and COSMALITE are essential.

DEPENDABLE • ECONOMICAL • LONG LASTING
Why pay more? . . . for the best call CLEVELAND

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A GRADE FOR EVERY NEED!

Available in diameters, wall thicknesses and lengths to meet regular or special adaptations.

CLEVELITE

Grade E	Improved post cure fabrication and stapling.
Grade EX	Special grade for TV deflection yoke sleeve.
Grade EE	Improved general purpose.
Grade EEX	Superior electrical and moisture absorption properties.
Grade EEE	Critical electrical and high voltage applications.
Grade XAX	Special grade for government phenolic specifications.

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Grade SP	Post cure fabrication and stapling.
Grade SS	General purpose.
Grade SSP	General purpose — punching grade.
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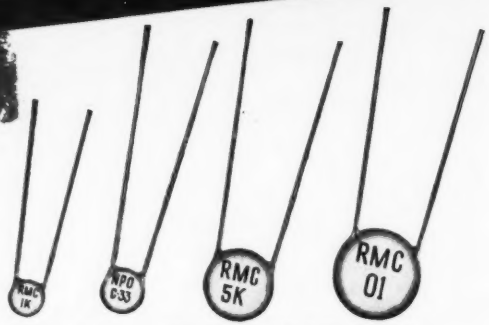
RMC CERAMIC DISCAPS

. . . THE MONEY-SAVING REPLACEMENT FOR MICA AND CERAMIC TUBULAR CONDENSERS

RMC DISCAPS are approved and used by leading manufacturers of TV sets and tuners, radio receivers and high frequency electronic equipment. In addition to their lower cost, they offer the advantages of small size, low self inductance, low power factor, high working voltage, greater mechanical strength and faster production line handling.



TYPE B DISCAPS

GMV By-Pass Series

Type B DISCAPS are the finest high frequency by-pass capacitors available and are engineered to exceed guaranteed minimum capacity at 85° C with 250 applied V.D.C. Capacity change between room temperature and 65° C is only +18%,—0%. Available in all standard capacities from .001 MFD to .02 MFD and in a number of dual capacity types.

SPECIFICATIONS

POWER FACTOR . . . . . 1.5% at 1 KC
WORKING VOLTAGE . . . . . 600 V.D.C.
TEST VOLTAGE . . . . . 1200 V.D.C.
INSULATION . . . . . Durez Phenolic—Vacuum Waxed
RESISTANCE . . . . . Initial 7500 Megohms
After Humidity 1000 Megohms
LEADS . . . . . #22 Tinned Copper (.026 DIA.)
CAPACITY TOLERANCE . . . . . GMV

TYPE C DISCAPS

NPO and TC

Type C DISCAPS are ideally suited to coupling and tuned circuit applications. Their capacity will not change under voltage. Available in a wide range of capacities and temperature coefficients conforming to the RMA specifications for Class I ceramic condensers.

SPECIFICATIONS

POWER FACTOR . . . . . Less than .1% at 1 Megacycle
WORKING VOLTAGE . . . . 600 V.D.C.
TEST VOLTAGE . . . . . 1200 V.D.C.
INSULATION . . . . . Durez Phenolic—Vacuum Waxed
RESISTANCE . . . . Initial 7500 Megohms
After Humidity 1000 Megohms
LEADS . . . . #22 Tinned Copper (.026 DIA.)
CAPACITY TOLERANCE . . . . . ±5%, ±10%, ±20%

TYPE D DISCAPS

STABLE CAPACITY

Specify Type D DISCAPS when a more stable capacity is required for coupling and by-passing filter networks. Available in a capacity range between 150 MMF and 5000 MMF. They feature a very small capacity change between +25° C and +85° C.

SPECIFICATIONS

POWER FACTOR . . . . . 1% at 1 KC
WORKING VOLTAGE . . . . . 600 V.D.C.
TEST VOLTAGE . . . . . 1200 V.D.C.
INSULATION . . . . . Durez Phenolic—Vacuum Waxed
RESISTANCE . . . . Initial 7500 Megohms
After Humidity 1000 Megohms
LEADS . . . #22 Tinned Copper (.026 DIA.)
CAPACITY TOLERANCE . . . . . ±20% at +25° C

NEW! RMC DEPENDABLE HI-VOLTAGE DISCAPS

ACTUAL SIZE

SPECIFICATIONS

CAPACITY . . . . . 500 MMF + 50% — 20%
WORKING VOLTAGE . . . . . 20,000 V.D.C.
TEST VOLTAGE . . . . . 30,000 V.D.C.
POWER FACTOR . . . . . 1% Max. at 1 KC
LEAKAGE RESISTANCE . . . . . Initial 7500 Megohms
After Humidity . . . . . 1000 Megohms
INSULATION . . . . . Moulded Plaskon

SEND FOR SAMPLES AND TECHNICAL DATA

DISCAP CERAMIC CONDENSERS

RADIO MATERIALS CORPORATION

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Two RMC Plants Devoted Exclusively to Ceramic Condensers

STANCOR
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manufactured with
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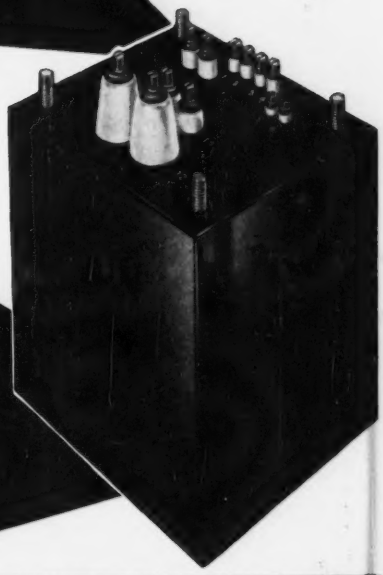

HELDOR
TRANSFORMER COMPONENTS
BUILT TO PASS MIL-T-27 SPECIFICATIONS

Standard Transformer Corporation, one of the nation's leading transformer manufacturers, selected HELDOR CANS and TERMINALS as the ideal components for the design and production of their Stancor OP 827 Transformer . . . built from start-to-finish to pass MIL-T-27 specifications.

If you have any problems with Hermetic Seal Bushings, avail yourself of Heldor's free engineering counsel.

Whether your products must meet government specifications or not, it will pay you to standardize on HELDOR CANS, COMPRESSION-TYPE HERMETIC SEAL BUSHING ASSEMBLIES or COMPLETELY ASSEMBLED UNITS.

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Please send me prices and specifications on MIL-T-27 cans and bushings.

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Division of HELDOR BUSHING & TERMINAL CO., INC.
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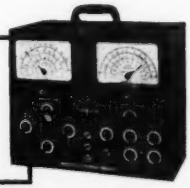
Exactly the same circuits, ranges and functions as the Model 480, with the exception of the oscilloscope.



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*PATENTS PENDING

ELECTRO TEC CORPORATION

SO. HACKENSACK NEW JERSEY

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Anything You May Need in TAPE-WOUND CORES

RANGE OF MATERIALS

Depending upon the specific properties required by the application, Arnold Tape-Wound Cores are available made of DELTAMAX . . . 4-79 MO-PERMALLOY . . . SUPERMALLOY . . . MUMETAL . . . 4750 ELECTRICAL METAL . . . or SELECTRON (grain-oriented silicon steel).

RANGE OF SIZES

Practically any size Tape-Wound Core can be supplied, from a fraction of a gram to several hundred pounds in weight. Toroidal cores are available in fifteen standard sizes with protective nylon cases. Special sizes of toroidal cores—and all cut cores, square or rectangular cores—are manufactured to meet your individual requirements.

RANGE OF TYPES

In each of the magnetic materials named, Arnold Tape-Wound Cores are produced in the following standard tape thicknesses: .012", .008", .004", .002", .001", .0005", or .00025", as required.

Applications

MAGNETIC AMPLIFIERS
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CURRENT TRANSFORMERS
WIDE-BAND TRANSFORMERS
NON-LINEAR RETARD COILS
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W&D 3063

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General Office & Plant: Marengo, Illinois

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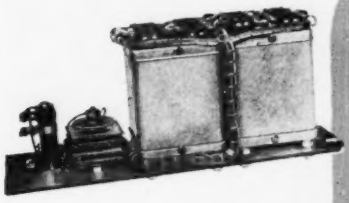
for
PRECISION CURRENT
CONTROL WITHOUT
MOVING PARTS



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for
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TO 1%, LESS THAN 1% RIPPLE

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its production and control
that's where Bogue's outstanding engineering ability is best able to help you, today!

Full control in one plant over the design of specialized equipment, plus extreme precision in production results in a quality of equipment not ordinarily available in an assembled unit.

The following high quality is available in Bogue-built power equipments: Practically pure DC supplies with voltage regulation and ripple held to within a small fraction of a percent . . . 1 KW to 150 KW; AC supplies at frequencies up to 20 KC with voltage regulation and harmonic content held to within a small fraction of a percent . . . 1 KW to 150 KW.

If you have a requirement along these lines, give us a call—engineers who are really experts in their chosen fields will be glad to discuss your problems.

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PRACTICALLY PURE
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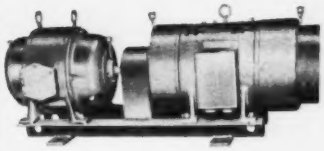

Bogue 400 Cycle Power
for
LABORATORY • PRODUCTION
TESTING OF
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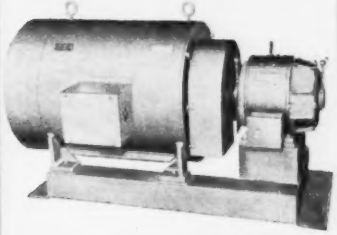

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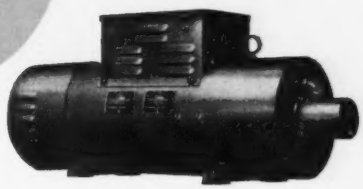

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PORTABLE INSTRUMENTS
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60
90
120
AMPERES
Westinghouse
10
20
30
40
50
60
VOLTS
PANEL INSTRUMENTS
40
60
20
80
D-C
AMPERES
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SWITCHBOARD INSTRUMENTS

Only a *complete line*

answers *all your* electrical measuring requirements

The case of Mastic Tile Corporation demonstrates how the complete line of Westinghouse Instruments holds answers to your electrical measurement problems.

Mastic's problem was one of predetermining load on a Banbury Mixer motor in order to facilitate the operator's job and speed the mixing cycle. It was answered by the standard Westinghouse GY-40 Recording Wattmeter with proper choice of scale, current and potential transformers, and chart speed. In fact, so well did this standard instrument accomplish its job that final results show—a 15 percent reduction in mixing cycle time along with the elimination of damaging surge shocks which can now be anticipated and prevented by the machine operator.

Westinghouse will continue to give you a wider selection for every need . . . whether it be a-c or d-c current and voltage, single or polyphase circuits, watts or vars, frequency, power factor, synchroscopes, temperature indicators, ground detectors or synchrotie. You get assurance of quality too, because every applicable instrument . . .

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Where would you go for help on springs with low relaxation at

750°F?

This view shows how the tube is placed on the spider which is held in place by an Inconel "X" spring.

Trutner and Boumans, Inc., Hillside, N. J., came to INCO.

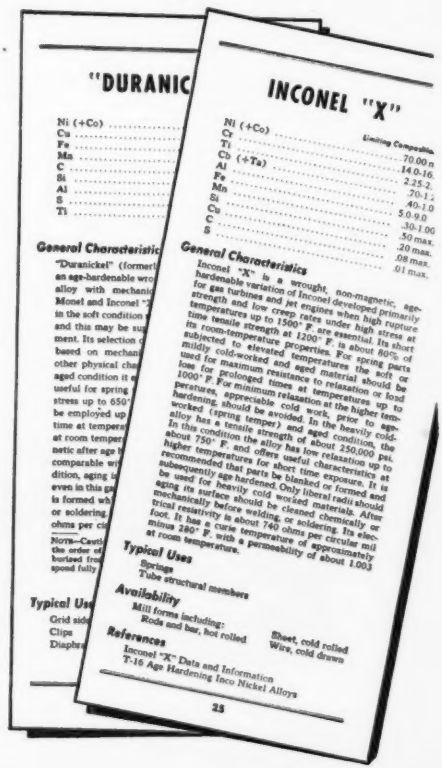
They had designed a new type of television tube screen baker. But they needed a spring material to hold the cathode tubes on a hot air tube – a spring material that would stand up in the 750°F. temperature of the oven.

INCO spring specialists studied the specifications and recommended .042" Inconel "X"® wire. Ten months passed – in steady, round-the-clock service – and not a single failure was reported.

The same research and knowledge that enabled INCO engineers to solve this metal problem are available to you. And to help you save time in the design stages of your electronic products INCO has recently published a revision of "INCO Nickel Alloys for Electronic Uses."

It discusses in short form the characteristics of various nickel alloys and gives limiting chemical compositions.

With the aid of this valuable booklet, you may be able to find the alloy having the exact electrical, corrosion or heat-resisting characteristics you need. A glance at the pages reproduced here will give you an idea of the wealth of information contained in the 26 pages. And remember, if you don't find the alloy you need, you can always call on INCO's Development and Research Division for help.



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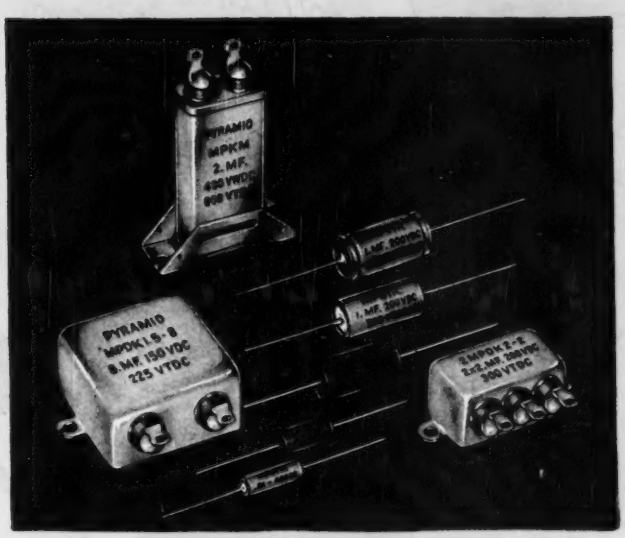
metallized paper capacitors



PYRAMID Series M CAPACITORS use a specially-prepared metallized paper, providing all-important savings in size and weight... Pyramid now produces large quantities of these capacitors in a wide variety of cardboard or hermetically sealed metal containers.

Your letterhead inquiries are invited

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Small Component... or Complete Unit... You* can count on getting whatever You* need—

Added Evidence that—

Everyone Can Count on VEEDER-ROOT

This REEL CONTROL BOX, complete with its *built-in* counting mechanism, indicates the number of feet of antenna reeled in and out of certain types of military aircraft. Manufactured completely by Veeder-Root, including outside bakelite cover and box, this unit shows another imaginative application of the universal language of direct-reading *Count*rol.

Now if you, *in any of your defense work,** have a counting problem, then you can count on Veeder-Root to help you in every possible way.

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ALL Du Mont Teletrons are Guaranteed for 6 months from date of installation

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Now Du Mont assures you of six months' protection from the day your receiver is installed in the customer's home, and insures still greater customer-confidence for your brand name. Du Mont offers the best guarantee protection today.

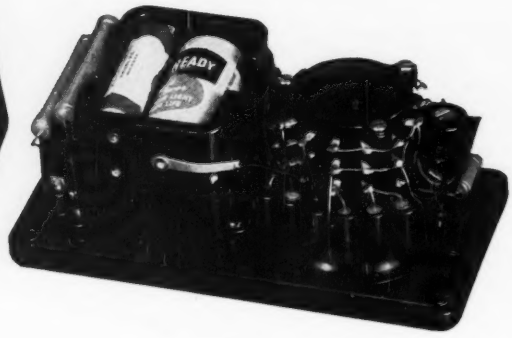
DU MONT

*Teletrons**

CATHODE-RAY TUBE DIVISION ALLEN B. DU MONT LABORATORIES, INC., CLIFTON, N. J. *Trade-mark

Model 666-R

NOTE the wide ranges of this compact pocket-size instrument. Note controls—flush with panel. Then study the inside view. Nowhere will you find, in design and manufacturing quality, the equal of 666-R.



A BASIC TOOL

POCKET-SIZE: VOLT-OHM-MIL-AMMETER

WITH SELF-CONTAINED RESISTANCE RANGES TO 3 MEGOHMS

1. Resistance Ranges from 0-3000 Ohms (.5 Ohm low reading) to 3 Megohms, self-contained. Also A.C.-D.C. Volts to 5000, 10 ranges; and 3 Direct Current ranges.

2. Enclosed Selector Switch, molded construction. Keeps dirt out, and retains contact alignment permanently.

3. Unit Construction—Resistors, shunts, rectifier, batteries, are housed in a molded base integral with the switch. Direct connections without cabling. No chance for shorts.

4. Resistors are precision film or wire-wound types, each in its own compartment.

ONLY $26.50—at your Distributor

Prices Subject to Change

FOR THE MAN WHO TAKES PRIDE IN HIS WORK

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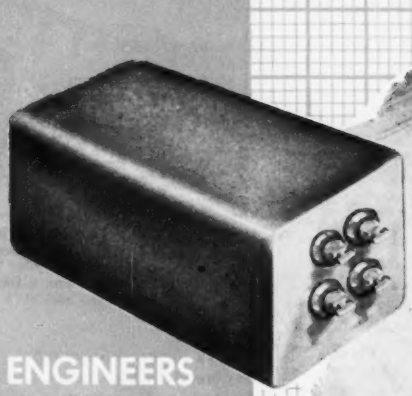
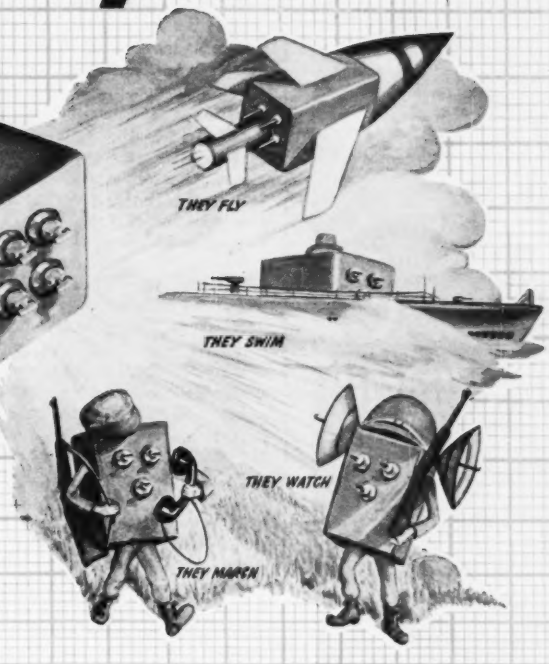
TRIPLETT ELECTRICAL INSTRUMENT CO., BLUFFTON, OHIO, U. S. A.

It's No Top Secret





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THE VARIED AND OFTEN UNUSUAL APPLICATIONS THAT HAVE BEEN FOUND FOR TOROIDS AND FILTERS IN MILITARY ELECTRONICS HAVE KEPT OUR ENGINEERING STAFF CONSTANTLY ON ITS TOES. EVERY DAY WE ARE CONFRONTED WITH THE TECHNICAL PROBLEMS OF OUR CUSTOMERS WHO ARE TRYING TO MEET THE DEMAND FOR SMALLER, LIGHTER AND MORE SERVICEABLE EQUIPMENT. FORTUNATELY OUR INGENUITY AND EXPERIENCE HAS SERVED US IN GOOD STEAD IN THE DEVELOPMENT OF FILTERS TO MEET THESE DEMANDS. CONSEQUENTLY IT IS WITH MORE THAN A LITTLE PRIDE THAT WE SEE OUR PRODUCTS SPECIFIED BY MORE AND MORE ENGINEERS WHO CANNOT BUT REALIZE THAT IN THE DESIGN OF QUALITY EQUIPMENT THE "BILL OF MATERIALS" SHOULD INCLUDE BURNELL PRODUCTS.

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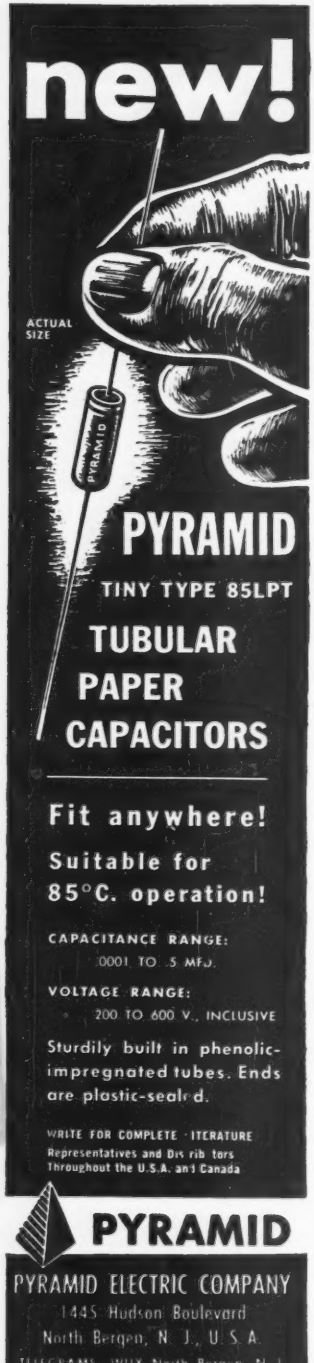
EXCLUSIVE MANUFACTURERS OF COMMUNICATIONS NETWORK COMPONENTS



BUSINESS BRIEFS

By W. W. MacDONALD

SEMICONDUCTORS are being studied by 28 percent of the research personnel in one of the largest laboratories in our field, an indication of probable future importance of the subject. The metallurgical work going on in this laboratory and elsewhere aimed primarily at development of better transistors is, curiously, also proving of value in the development of better tube cathodes.

SPEAKING OF TUBES, the subject of reliability, to which we devoted so much space in this column a year or so ago, is once again bubbling to the surface. Cooperation between aviation customers and tube manufacturers at that time has since resulted in substantially better types for this class of service. So has cooperation between the military and tube makers.

Industrial users of tubes are aware of the work going on in many places to increase tube reliability. That's why the subject is found on so many current convention programs, and why requests for more information on more reliable tubes are swelling the mail of tube manufacturers.

IN-LINE READOUT, which might be defined as "digital indication in the simplest possible form," (or, still more simply, as "reading from left to right without ambiguity, like the mileage total on your automobile speedometer) is very much in the minds of many men who design electronic instruments.

Modern instruments such as frequency meters, counters and computers perform a wide variety of functions rapidly and with a high order of accuracy. Making them easier to read, regardless of whether they are used in the laboratory or on the production line, is the next important step.

MINIATURIZATION of military apparatus, and particularly electronic component parts, is making rapid progress. Several

TUBE RELIABILITY depends to a large extent upon how hard the ambidextrous little bottles are worked, aptly illustrated by this drawing from a Department of Defense booklet

readers have asked us what effect this trend will ultimately have on the design of commercial gear.

Some techniques are already being carried over from military to commercial equipment, while others seem too expensive. So we think that commercial apparatus of tomorrow will be smaller than it is today but not as small as its military counterpart.

AIR FREIGHT carries most of the $32,000 mass spectrometers made by Consolidated Engineering despite the fact that the instruments are necessarily both bulky and heavy. Management says it saves money on packaging, that breakage is reduced, and that less time is required for adjustment following installation.

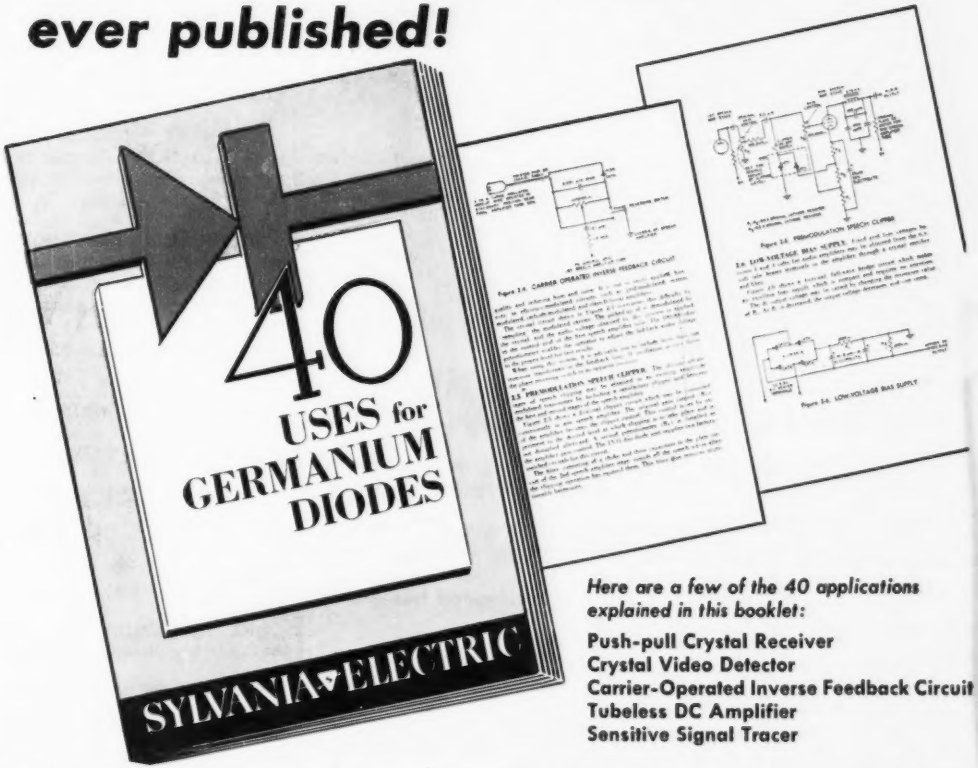
WE UNDERSTAND that RCA's Lancaster plant seals 500-kw tubes at 4 o'clock in the morning to avoid dimming the town's lights. The whole output of the laboratory's largest power supply is hooked to an induction heater for the job.

Fortunately for engineers who like to get home at night, the plant doesn't make one of these big bottles every day.

PUERTO RICO, with its attractive industrial tax exemption plan (p 60, Oct. 1950), has one active electronic equipment plant, the Rico Television Company, a subsidiary of Teletone. The company is assembling 1,200 table-type ra-

ENGINEERS, TECHNICIANS, HOBBYISTS—

Here's the most complete collection of Germanium Diode Applications ever published!



Here are a few of the 40 applications explained in this booklet:

Push-pull Crystal Receiver
Crystal Video Detector
Carrier-Operated Inverse Feedback Circuit
Tubeless DC Amplifier
Sensitive Signal Tracer

Sylvania's handy-sized book, "40 Uses for Germanium Diodes," presents for the first time all the most important applications of germanium diodes. In it, the engineer and technician will find time-saving devices and simplified circuits. Hams, hobbyists and experimenters will find plans for a host of interesting instruments and gadgets, from crystal receivers to voltage and frequency multipliers. Simple, clear explanations, plus more than 40 separate diagrams, describe germanium diode applications in receiver and transmitter circuits, instrument construction and electronic devices.

This book is full of new circuit ideas. It will save you time and money. It costs only 25 cents. Mail the coupon today with your quarter and your copy will be sent you at once.

RADIO TUBES; TELEVISION PICTURE TUBES; ELECTRONIC PRODUCTS; ELECTRONIC TEST EQUIPMENT; FLUORESCENT LAMPS, FIXTURES, SIGN TUBING, WIRING DEVICES; LIGHT BULBS; PHOTOLAMPS; TELEVISION SETS

SYLVANIA ELECTRIC

Sylvania Electric Products Inc.
Advertising Dept. E-2601
Emporium, Pa.

Please send me "40 Uses for Germanium Diodes"
Enclosed is $.25.

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SHOCK and VIBRATION NEWS

BARRYMOUNTS FOR ASSURED CONTROL OF SHOCK AND VIBRATION

ALL-METL BARRYMOUNTS

for unusual airborne applications

FOR EXTREME LOW TEMPERATURES

FOR EXTREME HIGH TEMPERATURES

Design Features of ALL-METL BARRYMOUNTS

1. . . . Outstanding vibration isolation under severe temperature and environmental conditions.
2. . . . High shock protection in accelerated take-offs and arrested landings.
3. . . . Unit mountings are interchangeable with mountings now in use.
4. . . . Complete line of ALL-METL mounting bases to JAN-C-172-A dimensions.
5. . . . Special ALL-METL bases made to customers' requirements.

FREE CATALOGS give dimensions and load ratings of stock BARRYMOUNTS. Write today for Catalog 509 describing ALL-METL unit mountings and mounting bases. Catalog 502, covering general aircraft applications, and Catalog 504, covering industrial mountings, are also free on request.

See our advertisement in Electronic Buyer's Guide pages 240-241

THE BARRY CORP.

707 PLEASANT ST., WATERTOWN 72, MASSACHUSETTS

SALES REPRESENTATIVES IN

New York Rochester Philadelphia Washington Cleveland Dayton Detroit
Chicago Minneapolis St. Louis Seattle Los Angeles Dallas Toronto Atlanta

dios per day, will soon start trial runs on tv sets. Two other companies are reported ready to open tv plants as soon as station facilities are available. A recent FCC allocations report recommends that tv licenses be issued for the island.

Rico employs 100 workers, mostly native women, whose natural skill with a needle helps them learn the operations they perform in set assembly. The supply of labor is said to be nearly inexhaustible.

AIRCRAFT CARRIERS use more than 13,000 electron tubes, not counting those used in planes carried by the carriers.

SHIPBOARD ELECTRONICS accounted for 700 million dollars of the fiscal year 1951's defense appropriation. During the current fiscal year additional procurement up to 500 million dollars is planned.

AMONG NAVY ORDERS for conversion of various existing ships the following items appear:

12 destroyers to radar picket destroyers
6 submarines to antisubmarine submarines
4 submarines to radar picket submarines
1 submarine to guided missile submarine

In warfare, it looks like electronics is here to stay.

DRY BATTERIES have more than 1,000 military applications.

NICE SET OF SIMILES attributed to Sylvania's E. Finley Carter:

"Both electron tubes and human beings suffer from a small but significant mortality in early life. If they survive the early critical period their chances for a long life are good.

"Tube failure because of defects in other components, because of contamination, and because of old age may be likened to human mortality by accident, by epidemic, and through ultimate old age.

"Tubes, like humans, can be damaged beyond repair by overwork or overloading."

INFLUENCE OF ELECTRONICS: Rohm & Haas describes translucent plastic sheets intended to be inset into corru-

gated metal factory walls for lighting purposes as having corrugations with the "same frequency and amplitude" as the metal.

ELECTRONIC MOISTURE METERS are being widely used in the agricultural and food fields. Among the things for which Tagliabue (Weston) instruments are calibrated are

Almonds
Barley
Beans
Buckwheat
Corn
Corn Starch
Flaxseed
Hops
Oats
Peanuts
Pecans
Popcorn
Rice
Rye
Seeds
Sorghums
Soybeans
Vetch
Walnuts
Wheat

They are also calibrated for tobacco and for

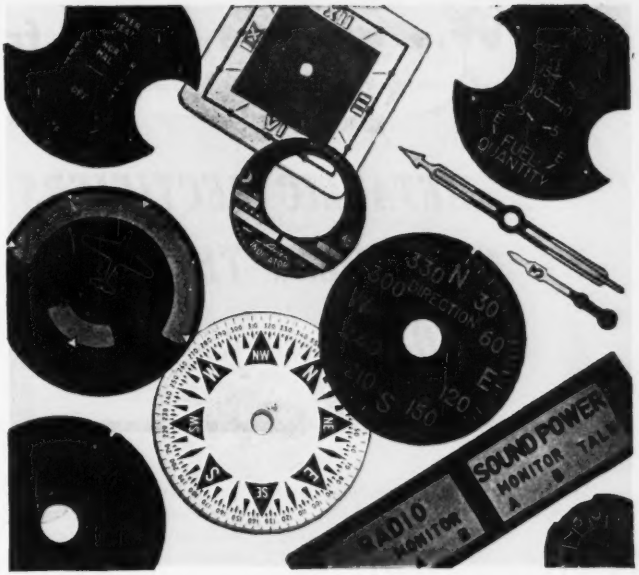
Ash
Basswood
Birch
Cypress
Elm
Fir
Gum
Hemlock
Hickory
Larch
Magnolia
Mahogany
Maple
Oak
Pine
Poplar
Redwood
Shorea
Spruce
Walnut

NEARLY 2 MILLION wire and tape machines have been sold since magnetic recorders were first offered commercially, according to Webster-Chicago's W. S. Hartford.

HOW'S THAT AGAIN: The National Labor Relations Board recently held that the Jefferson Standard Broadcasting Company of Charlotte, N. C., operator of WBT and WBT-TV, did not violate the Labor-Management Relations Act by discharging an employee who circulated handbills disparaging the stations' programs as second rate.

A FRIEND reports that he telephoned a company in our field late one evening and asked to be connected with the engineering department. There was a perceptible pause and then a feminine voice at the other end of the wire said: "Oh, you mean the *cone heads*."

Precisely what the lady implied remains veiled in mystery.



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CROSS TALK

►**WRECK . . .** The train wreck in Wyoming last November, in which more than 20 people were killed, inspired the editor of the San Antonio *Light*, one of the Hearst chain, to write "the great challenge to communications science remains today exactly what it was five years ago—the perfection of a system of two-way radio capable of giving instant instructions to train crews when disaster is imminent".

Here we have an accurate statement of a need, but confusion as to modus operandi. This is not a challenge to communications science. The techniques are available, were available long before Mr. Hearst first wrote about the need in 1946. The problem is operational and economic, not technical. Railroad operators must find the economic justification for installation of equipment and training of personnel, suitable for accident prevention as well as more routine uses, and they must develop operational procedures which will prevent equipment or personnel failure when disaster impends.

This is a costly business, but technically straightforward. The electronics industry is ready to offer a sound solution to the problem, but it needs a welcoming hand from the railroaders, not "we can't possibly pay for anything like that!" The need for some kind of electronic disaster-prevention control is evident; it has already been accepted and paid for by passenger-carrying ships, and a start has been made in a very much more difficult medium, air travel. Lives of rail passengers will no doubt continue to be lost while economic roadblocks stand in the way of the fruits of existing technology.

►**FIGURE . . .** A reliable Defense Department source informs us that the money appropriated and spent for electronic equipment and installations by the Armed Forces has amounted to $6 billion during the period December 1949 to July 1951, an average of about $4 billion a year. It is dangerous to compare this figure with previous allocations and expenditures which may have been arrived at on a different basis. But we are reminded that the peak expenditure in World War II occurred in 1944, and the figure then was $4.6 billion for the year. Moreover during the 1949-51 period mentioned, we had a civilian economy in electronics virtually unaffected by defense demands. We've come a long way, friends, since 1944 and the end is not in sight.

►**MINOR MIRACLE . . .** At the Toronto Fall meeting, W. B. Whalley described a new vertical-deflection circuit for tv sets that has greatly improved linearity and, mirabile dictu, costs *less* than conventional circuits. This is a very rare occurrence indeed among circuit designers and one worthy of special mention. For years tv set designers have been unwilling to spend money on stabilization of vertical linearity because the performance of tv broadcasters in this respect is so poor that the set owner would never know the difference. But if it *saves* money, that's different. We can't hope for many minor miracles like this, but we can emphasize the suspicion that at the average tv station the equipment is not as well adjusted, in scanning, as the sets that are tuned to it, and this condition acts as a strong brake on improvements in set design.

►**FAITH . . .** In a description of the Canadian atomic pile at the Chalk River (*Physics Today*, November), we find the statement that Friday afternoon is the busiest time around the pile, because the physicists are then setting up their electronic counting and recording apparatus to work for them on a long run over the weekend. Then follows, "This implies faith in the reliability of electronic apparatus which has been won only by much attention in design and maintenance specifically directed towards achieving reliability".

For the faith, we give thanks, even if the faith of a physicist is more readily won than that of the manager of a steel plant. To the prescription of "much attention in design and maintenance" we say, Amen! And if physicists can do it, so can anyone else who goes about it with care and understanding.

PROTUBERANCES Though still permitted on relatively slow planes such as this Boeing-made C-97 Stratofreighter, all protruding antennas and radomes are much deprecated for travel at speeds approaching or exceeding Mach 1

Aircraft Plants

By JOHN MARKUS

Associate Editor

ELECTRONICS

AT SUPERSONIC SPEEDS, things happen so fast in a military airplane that automatic devices become essential for the control of flight and fighting. Target-finding, gun aiming, gun firing, bomb aiming, bomb guidance, identification and navigation are just a few of the functions relegated to electronic equipment in modern planes. These electronic systems are so complex and so integrated with each other that they must be designed into the plane rather than shoved into or stuck onto a finished airframe.

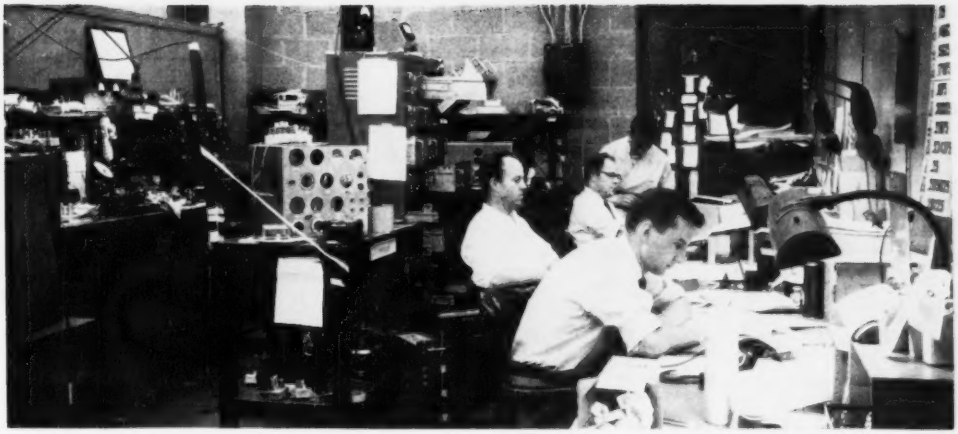
The new electronic systems requirement has caused airplane builders to hire more electronic engineers and establish electronic research and development departments. In most cases these new departments work on an equal basis with older aerodynamic, weight, stress, and power plant groups. This is both fitting and essential, because in many planes currently in production the electronic equipment represents well over a quarter of the total cost. The electronic requirements of aviation, building up gradually from the simple black-box radios of the first world war, today represent a new branch of electronics second to none in importance, size and dollar value.

Early Black Boxes

In the days of the Jenny, De Havilland, Spad and Nieuport fighters, the aircraft manufacturer turned out plain and simple airplanes and a pilot flew by the seat of his pants. When weather was bad he stayed on the ground because he couldn't see the enemy anyway.

The advent of two-way aircraft radio along about the end of World War I did not change the plane-building picture. The military airframe manufacturer still turned out pure airplanes and the electronic engineer designed and built the black boxes separately. Installation, done by squadron crews, involved mounting the trailing-wire antenna reel outside the fuselage within reach of the pilot and supporting the transmitter and receiver black boxes inside the fuselage with shock cord and springs, plus elaborate shielding of the engine ignition system. The radio installation belonged to the squad-

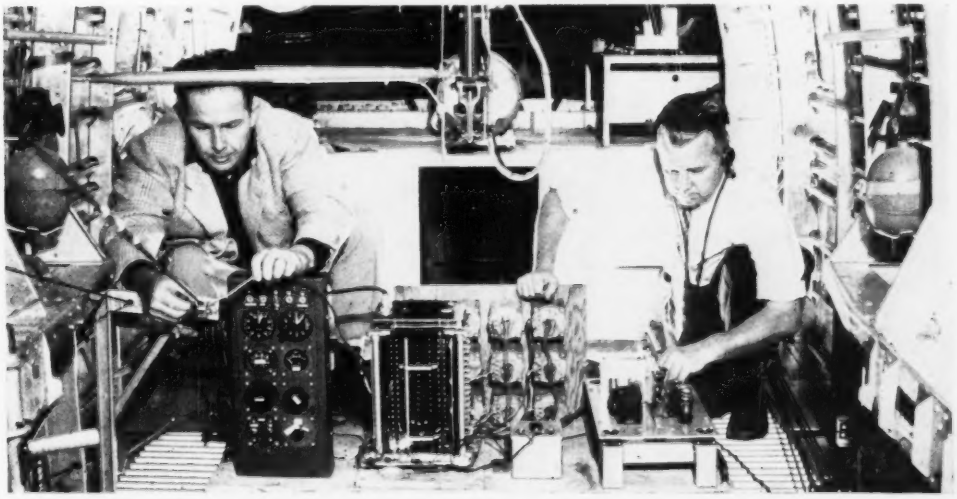
RADAR CHECK Final on-the-ground check of radar equipment in radar observer's station of Northrop Black Widow F-61 night fighter



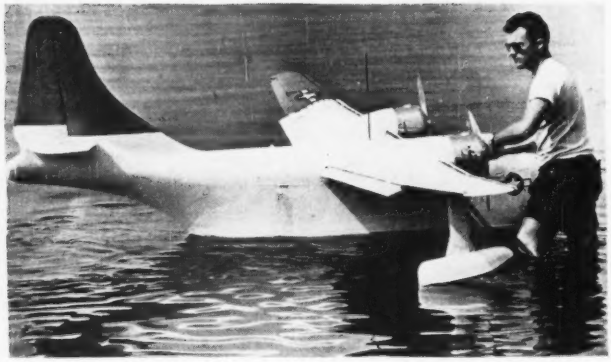
COMPUTER TEAM Electronic engineers make extensive use of analog computers to replace try-and-see or crystal-ball techniques for finding out whether a proposed new idea will work. Here evaluation group for experimental analog computer at Cornell Aeronautical Laboratory converts computer readings into yes-or-no decisions for new airborne electronic control designs

and Electronic Engineers

The Korean invasion accelerated transfer of responsibility to aircraft manufacturers for performance of electronic gear in fighting planes, forcing them to recruit more electronic engineers. Today these transplanted engineers do a variety of jobs



IN-THE-AIR TESTS Convair electronic engineers install a pressure-survey panel and strain recorder in B-24D in preparation for flight tests that involve checking of airframe performance as well as electronic gear



RADIO-CONTROLLED MODEL Free-flight radio-controlled models such as this are used extensively at Consolidated Vultee Aircraft Corporation's San Diego labs to facilitate solution of many Convair hydrodynamic design problems. For many electronic engineers, assignment to the radio control group is play combined with work

ron and stayed with the squadron when the airplane was transferred.

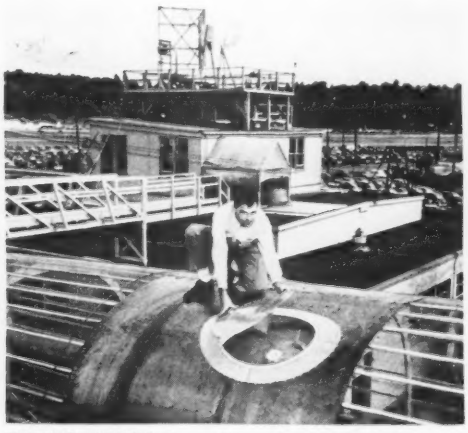
The Radar Era

During World War II, electronic engineers largely stayed in their own factories while aircraft manufacturers produced and delivered standard military airplanes having only the minimum electronic equipment need for flying. This had the advantage of keeping aircraft production rate high because production was independent of the frequent changes in electronic equipment design. The airplanes were fitted with final equipment at one of twelve or more modification centers, most of which were also operated by aircraft manufacturers.

Increasing complexity of airborne electronic gear emphasized the many drawbacks of the modification-center technique. There was a tendency toward laxness because the responsibility for installing, adjusting and flight-testing was held by the military. More important was impairment of airplane performance by addition of radome and antenna protruberances, by addition of weight at locations not considered in original design and by addition of generators that robbed engines of badly needed power. Worse yet, there were many cases where bombing radar had not even been considered in basic design, with the result that a gun turret or other major structure was located at the optimum location for the bombing radar antenna. Finally, there was little or no channeling of essential airframe design changes back to the airframe manufacturer, hence correctable errors went uncorrected. In a nutshell, there was little liaison and cooperation among airframe designers, electronic equipment designers and the engineers who had to squeeze the electronic gear into or onto the plane.

The Turning Point

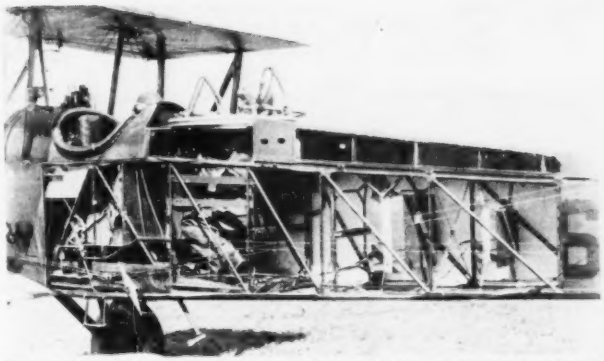
Modification centers were terminated at the end of the war in 1945, and all their work was given to aircraft manufacturers to help keep staffs going. This was the beginning of the exodus of electronic engineers from their own plants into aircraft factories. But the transition in responsibility for installing and checking out electronic



ANTENNA MOCKUP For testing performance of flush-mounted antennas, wire mesh is as effective as regular aluminum airplane skin. Boeing engineer Michael Schwartz is here fitting such an antenna on a full-size mockup of the Boeing B-47 Stratojet bomber. Structures in background check radiation patterns of scale-model antennas on scale-model planes

PRODUCTION Though most airborne electronic equipment still comes from electronic manufacturers, small runs of a newly designed unit are at times produced right in the aircraft plant. Here chief electronic engineer J. M. Pearce (right) and electronic design engineer H. W. Royce look over some of the equipment turned out in The Glenn L. Martin Co. Baltimore plant

equipment was not an overnight affair with every manufacturer. Some companies started by taking over the responsibility for bench tests of military electronic gear, then graduated to in-the-plane tests and finally to flight tests. Radar was the last of the electronic gear to come under the responsibility of the aircraft manufacturer's electronic engineers, even though radar antenna requirements have the most effect on airframe design. The gradual transition, limited pre-Korean production of military aircraft and inherent reluctance of long-established aircraft manufacturers to change their thinking overnight all still served to hold down the migration of electronic engineers.



EARLY BLACK BOXES Experimental installation of Radio Set SCR-134 in De Haviland two-seater fighter about 1926, using coil springs instead of shock cord to support the two boxes in fuselage space behind machine-gunner. Vibration was so great that they went back to shock cord. Weighted trailing-wire antenna was lowered through slanting pipe under gunner's feet—Air Force Photo

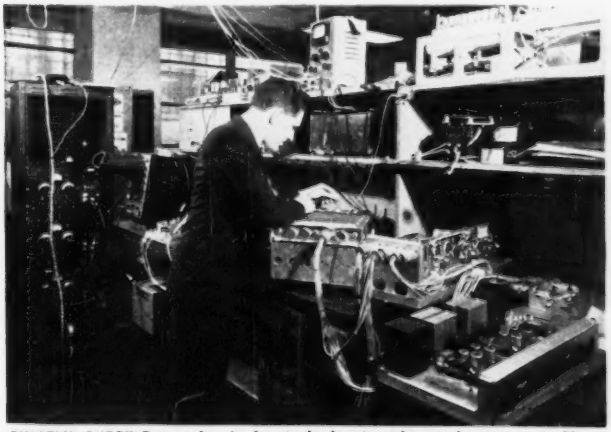
Korean Stimulus

Military aircraft orders built up in volume rapidly after UN troops entered Korea. These orders gave complete responsibility to aircraft manufacturers for installation and performance of all electronic equipment, and some even involved electronic research and development. Thus was created an urgent need for electronic engineers in aircraft plants. Intensive recruiting campaigns brought results, and today these engineers are firmly established in a variety of jobs all contributing to the design and production of better military aircraft. The illustrations in this article show some of these engineers at work.

The Air Force today wants all-weather fighting planes, usable day and night when needed, regardless of fog, snow, rain and other weather conditions that conceal the target and the landing runways of home base, and regardless of atmospheric static that formerly interfered with radio communication. The primary job of the electronic engineer is to open up the dark and zero-ceiling fog hours to flying and fighting. For each pound of electronic equipment added for this purpose, the gross weight of the plane must be boosted as much as 7.5 pounds to get the same range and pay load, hence counting the ounces has become a new instinctive reaction for the electronic engineer in an aircraft plant.

The electronic industry has gained tremendously by closer contact with the aircraft industry, because no aircraft plants produce all their own electronic equipment. A few may turn out pilot models or even small model-shop runs of a special electronic unit, but large production orders are usually farmed out to the electronic industry either by the aircraft manufacturer or the military purchaser. Guided-missile manufacturers are generally authorized to build their own electronic equipment, but only because standard black-box units for missile control are not yet available.

By finding ways to improve the usefulness of existing electronic black boxes and by helping to develop improved or new units, the transplanted electronic engineer is also helping the military and the aircraft industry to match the production figures of the last war, even though the fighting plane of today is vastly more complex than ever before.



SYSTEMS CHECK Rare today is the single-chassis airborne electronic unit. Many units must be hooked together each time an advanced development is checked, as is being done in this electronics lab at The Glenn L. Martin Company's plant in Baltimore. Interconnection of systems, layout and shielding of wiring, layout of equipment so units cannot bump each other and provision for clearance needed to remove units are just a few new duties of the electronic engineer

Standards Conversion

By V. K. ZWORYKIN and E. G. RAMBERG

RCA Laboratories Division
Radio Corporation of America
David Sarnoff Research Center
Princeton, New Jersey

WITH DIFFERENT television standards in various areas of the world, converting picture signals from one set of standards to another is a problem requiring an early solution.

It is most urgent in those areas within reach of stations operating on different standards and, in the long term view, to meet the future need for direct exchange of programs between continents. In most contiguous regions, the difference between standards affects only the line frequency, but there are instances where the frame frequency differs as well.[1]

The present discussion deals specifically with problems raised by program interchange between stations operating with 525 lines, 60 fields interlaced and with 625 lines, 50 fields interlaced—the standards prevalent in the western hemisphere and most countries of continental Europe, respectively.

There are, in principle, two different approaches to the problem of conversion; namely, recording of the program and subsequent retransmission and the continuous and immediate translation of the picture signals from one set of standards to the other with the aid of suitable storage devices.

Only the first of these is at present capable of yielding satisfactory reproductions. Furthermore, motion-picture film is the only recording medium which has proved practical so far. With high-speed film development, delay between reception and retransmission need only be a minute.

Photographic Recording

The intermediate film technique is simplest for the transition 525/60 to 625/50. For this purpose it is sufficient to employ standard film-recording equipment[2] which produces 24 frame-per-second positive film by photographing the 60-field-per-second negative image on the face of a suitable picture tube, blanking every sixth half-field for proper pulldown as required.

The time division for this process is shown in Fig. 1. An electronic counter is employed to control the exposure in such fashion that exactly 525 lines are scanned for every exposed frame. This prevents banding at the center of the picture. The sound may be recorded directly on the film with the picture or may be recorded separately.

The film obtained is standard 16-mm film and could be reproduced with any 16-mm film-scanning equipment designed for 50-field-per-second transmissions. The pitch of the sound will be increased in the ratio of 25/24, but this is not regarded as objectionable in practice and applies quite generally for normal transmission of standard 35-mm sound film on 50-field-per-second television systems.

The transition from 625/50 to 525/60 offers somewhat greater difficulties, but here, also, the necessary equipment is available. A Cameflex Eclair camera[3] synchronized with the received 50-field-per-second signal may be employed to produce a 16⅔-frame-per-second negative film by photography of a kinescope face, every third field period being utilized for pull-down. Figure 2 shows the time division.

This film is then printed so that

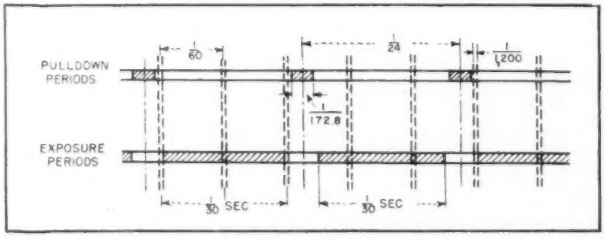


FIG. 1—Time division for recording 60-field-per-second transmissions on film

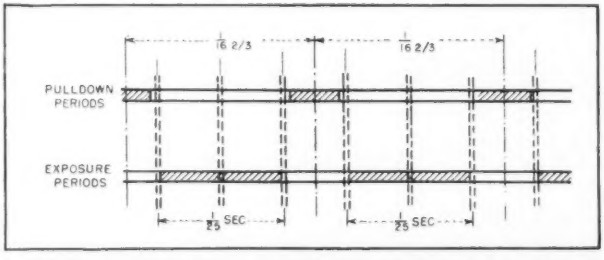


FIG. 2—Time division for recording 50-field-per-second transmissions on film

# of Television Signals

Although there are a number of techniques for converting picture signals from one set of standards to another with a different frame rate, such as from 625/50 to 525/60, they all possess some inherent drawbacks. The intermediate-film process and instantaneous methods are discussed and remedies suggested

every second frame is recorded twice, such printers being available at present for the conversion of 16-frame silent film into 24-frame sound film. Sound must be recorded separately and may also be printed on the resulting 25-frame-per-second positive film. As an alternative, the step-printing can be carried out in the camera itself and the sound be recorded directly on the positive. The resulting film may be employed in standard American television film scanners. The pitch of the sound will be lowered in the ratio 24/25.

Techniques also exist for recording 25 frame-per-second film directly from 50 field-per-second transmissions without loss of interlace. These employ continuously moving film. Thus, in a modified Mechau optical compensation projector[4] the tilting of a mirror on a rotating drum holds the image of the kinescope face stationary on the moving film for the course of a frame time; the next mirror on the drum transfers the image to the next frame on the film.

In another system, the so-called split-field method, the picture is formed, compressed to half-size in the vertical direction, on the screen of a flying-spot tube.[5] Two alternative optical paths, for odd and even interlaced fields respectively, are provided for imaging the picture on the film. A rotating shutter selects one or the other in alternate fields. The reduced vertical deflection on the tube screen and the motion of the film combine to record the picture on the film with the proper ratio of height to width.

In all cases it is desirable to take special care that line structure is absent from the recorded images. In the presence of line structure, interference between the two scanning patterns can give rise to a system of horizontal bars in the picture; the frequency of this brightness modulation will be $(625 - 525)/2 = 50$ per field time, so that the bars will be 1/50 picture height or some 10 to 12 scanning lines apart. (In practice, vertical blanking will slightly reduce the number of bars observed and increase their separation in terms of picture height.) This effect may be rendered negligible without appreciable loss of picture resolution by applying a small-amplitude high-frequency vertical spot wobble to the kinescope scanning beam.

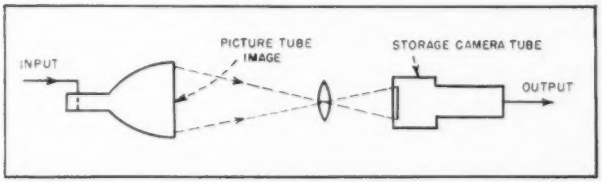


FIG. 3—System for instantaneous conversion of picture signals to different standards

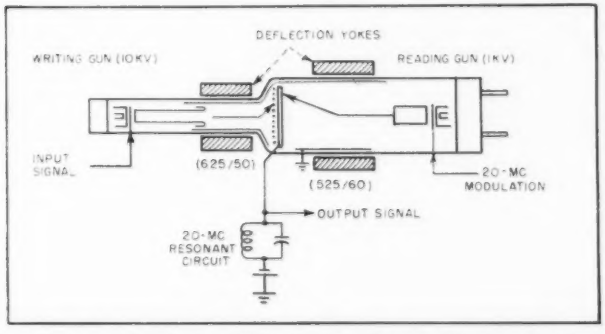


FIG. 4—The Graphechon as standards converter. The writing beam produces bombardment conductivity in the screen-supported insulating target

Time Difference

In principle, neither transformation can be carried out without time delay, since the rates of transmission of the original program and of the prepared film differ. Thus a continuous hour-long broadcast which is transformed to the 625/50 standard would take only 57.6 minutes to rebroadcast; the initial time delay between broadcast and rebroadcast would hence have to be 2.4 minutes plus the time required for preparing the film. In the opposite direction the delay between broadcast and rebroadcast would

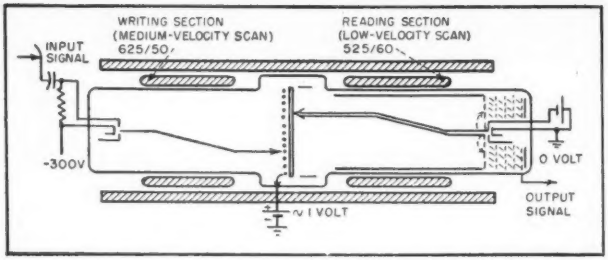


FIG. 5—Standards converter with image-orthicon-type reading section

increase by 2.5 minutes between the beginning and the end of the program.

A more serious objection to the intermediate film process is the great care demanded in the control of development to prevent undue distortion in the transmitted picture signals. Some loss of picture detail is also inherent in the photographic process, and particularly with the type of 16-mm film which is today most widely used for video recordings.

Immediate Conversion

Instantaneous methods of signal transformation necessarily involve storage of the original signals (the written signals) for periods of the order of the rebroadcasting frame time (the reading period). If existing devices are to be employed, the storage may be supplied by a storage-type camera tube; the original picture, reproduced on the face of a kinescope, is imaged on the photosensitive surface of this tube (Fig. 3).

The interposition of a viewing screen between the picture tube and the camera tube may be convenient for checking the adjustment of the kinescope image, but only adds to the deterioration of the final picture. By contrast the use of a storage tube, such as the Graphechon[6], as a standards converter has the advantage of eliminating the optical imaging process. Here a charge image is traced out on a target by a writing beam controlled by the original picture signals and this is, in turn, read off by a reading beam to provide picture signals on the new standards (Fig. 4).

Instantaneous conversion between standards with equal field rates and different line rates has been discussed[7] and some difficulties have been pointed out. These are:

The superposition of the written signal on the read signal.

Interference effects between the two scanning patterns.

Variation in stored signal, depending on the relative instantaneous position of writing spot and reading spot.

Weakening and distortion of the transferred signal by redistribution in the camera tube, such as the iconoscope and image iconoscope, in which storage of the written signal is not saturated.

The last consideration renders tubes of the iconoscope and image iconoscope type unsuitable as storage tubes in conversion systems.

Remedies

Ways in which the other difficulties may be overcome in the conversion between standards with equal field rates have also been indicated. In orthicons, vidicons, and graphechons, in which the output signal is obtained from the signal plate of the target, separation of output and input signals may be effected by high-frequency modulation of the reading beam and the insertion of a corresponding band-pass filter in the output circuit; in the image orthicon or any other storage tube in which the reading signal is separately derived from a collector or electron multiplier (Fig. 5) this is unnecessary.

Interference between scanning patterns may be eliminated by minimizing line structure in the written image, eventually by supplying an appropriate high-frequency vertical wobble to the writing beam.

The variation in the transferred signals with relative position of reading and writing spot can be minimized by establishng a large phase difference (for example, $\frac{1}{2}$ field period) between the vertical deflections of the reading and writing beams.

The remedies, with the exception of the last, apply also if the standards differ in field frequency as well as in line frequency. The difference in the field period now causes a continuous change in the relative phase of the writing and reading spots. This is accompanied by intensity fluctuations in the image whose nature depends on the dimensioning of the writing and reading spots.

These will be examined next, with special reference to a uniformly illuminated object field. In addition, it will be noted under what circumstances the resolution conveyed by interlace is preserved.

It is assumed that writing storage is complete for times of the order of a frame period of the writing beam, that erasure by the reading beam is complete, and that the writing process is instantaneous. This signifies, in the kinescope-camera tube conversion system, that the decay time of the phosphor is small compared to a field period of the reading or writing process, whichever is shorter.

The simplest conditions are realized if both the writing spot and the reading spot are given (eventually by spot wobble) a vertical height just equal to two line widths. This is the only condition for which a flat object field gives rise throughout to individually flat image fields and for which, furthermore, the resolution conveyed by interlacing is preserved for a single frame.

The relationship between the writing and reading spots for signal transformation between 525/60 and 625/50 standards may be represented by Fig. 6. The horizontal scale here represents time, the vertical scale, the vertical position of the writing spot (broken line) and reading spot (full line) on the scanning pattern. The arrows indicate the interval between storage (writing) and erasure (reading) of the picture signals.

The basic period of repetition is $\frac{1}{5}$ second, corresponding to the frequency difference between the two frame frequencies. Successive subperiods of 1/10 second are not identical. To consider a single such subperiod, for all but the first reading field the picture signals are provided simply by the preceding writing field; furthermore, odd and even writing fields provide signals for odd and even reading fields, respectively. The first reading field, however, derives its signals from the sum of the two preceding fields for the transformation 525/60 to 625/50 and is entirely free of picture signals for the transformation 625/50 to 525/60.

Every fifth field of a reproduced 50-cycle picture has double brightness, every sixth field of a reproduced 60-cycle picture is black. It must be anticipated that this jump in picture brightness, with a repetition rate of 10 cps, will prove disturbing to the viewer. Since the 50-cycle system and 60-cycle system are not synchronized, the phase of the anomalous field period will tend to drift, rendering correcting measures difficult. It will not coincide exactly with one scanning field as in the figure, but be distributed in some fashion between two successive reading fields.

Interlace Resolution

In the next succeeding subperiod of 1/10 second, odd writing fields produce the picture signals for even reading fields and vice versa. It can readily be demonstrated that this inversion in the relationship of the interlaced fields leads to a loss of the vertical resolution resulting from interlacing.

For example, suppose that the original picture consists of 263 odd black lines and 262 even white lines. Then, in the first subperiod odd lines of the reproduced 625/50 picture will be black, even lines white; however, in the next subperiod the odd lines will be white and the even lines black, so that, averaged over a full $\frac{1}{5}$-second period, the picture will appear a uniform gray.

The loss of interlace resolution and the presence of the low-frequency field flicker described above clearly render a system employing double-width reading and writing spots unusable for practical use.

When, instead, a single-line-width writing spot is employed in conjunction with a double-width reading spot, the only change which results is that, now, a bar moiré (with a period of 1/50 picture height) appears in the individual field. For rectangular spots with uniform distribution the fluctuation amplitude for a transition from 625/50 to 525/60 may be shown to ±16 percent for a single field; for a frame it is reduced to half this value and averaged over the entire period of $\frac{1}{5}$ second it vanishes. Loss of interlace resolution and 10-cps field flicker occur as in the preceding example.

With a double-width writing spot and a single line width reading spot, interlace resolution is lost even for a single frame; on the other hand, the intensity, for a flat object field, is reduced, for the transition 625/50 to 525/60, to half on two fields in each 1/10-second subperiod, instead of to zero on one of them.

Figure 7 shows a diagram corresponding to Fig. 6 which applies to this example. The charge patterns on the storage tube target are represented in Fig. 8; shaded areas represent the signal taken off in the indicated reading field.

Improved Resolution

Evidently, the preservation of interlace resolution is not consistent with the reproduction of a flat object field by individually flat image fields or image frames when the field frequency is changed, provided that our general assumptions regarding full storage, complete erasure, and instantaneous writing are fulfilled. Consider, then, the intensity variation in the image

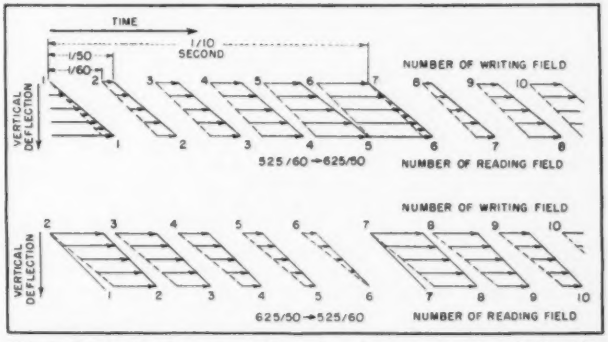


FIG. 6—Relationship between writing and reading process when double-width reading spot is employed

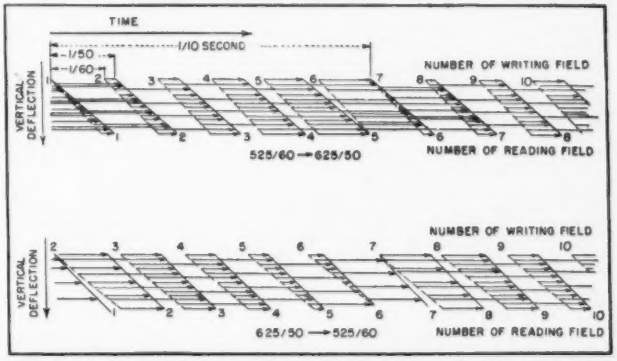


FIG. 7—Relationship between writing and reading process when single-line-width reading spot is employed

which may be expected with rectangular writing and reading spots whose vertical extent is exactly equal to a line width. Interlace resolution is now preserved.

The picture signals obtained for a sequence of 12 reading lines and an equal number of reading fields (constituting one complete $\frac{1}{5}$-second period) are shown in Fig. 9. This chart indicates: The average intensity for two fields out of six is reduced to half that of the remaining fields, as for the last example. The four normal fields are flat; in the two anomalous fields the line intensity fluctuates approximately in the ratio of 5:1. Averaged over a full $\frac{1}{5}$ second period, the line intensity is constant.

In brief, interlace resolution is purchased at the cost of a fluctuating intensity variation within the image (with a periodicity of 1/50 picture height) added onto the field flicker which is observed in systems with double spot width. This probably represents the best compromise which can be achieved under the assumed conditions.

The effect of incomplete storage, such as might be present with a leaky camera tube target, can most readily be recognized with a diagram like that in Fig. 6. It shows that the picture signal would decrease with increasing length of the arrows shown. Thus, for the transition 525/60 to 625/50, there would be a gradual decrease in intensity in the course of a 1/10-second subperiod, terminated in an abrupt increase; for the transition 625/50 to 525/60, there would be instead a gradual increase in image intensity terminated by an abrupt drop to zero. This should prove more disturbing than the contrast variation with perfect storage. Interlace resolution would be lost as before.

Incomplete erasure by the reading beam would cause trailing for moving objects; at the same time it would reduce somewhat the amplitude of the intensity fluctuations.

If the writing process is not instantaneous, but persists for an appreciable fraction of the writing frame period (as the result of the persistence of the picture-tube phosphor in a kinescope-camera tube converter) the amplitude of the intensity fluctuations also is reduced. Trailing will be observed if the persistence exceeds a frame period. Since phosphor decay is not abrupt, but gradual, some trailing will be noted if the decay is made slow enough to greatly reduce the field and bar flicker which is observed with a rapidly decaying phosphor.

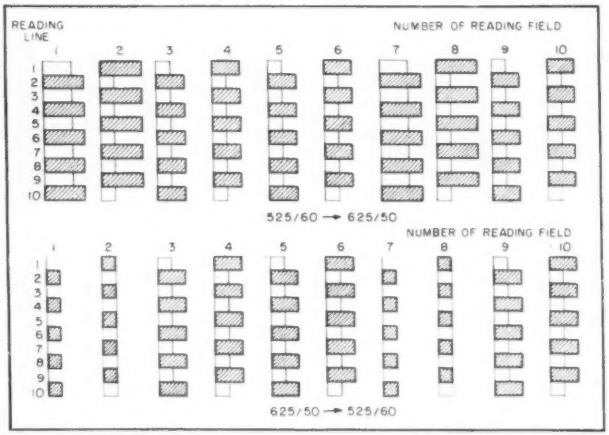


FIG. 8—Picture signal (shaded area) and charge left after reading (clear area) for flat object field when double-width writing beam and single-line width reading beam is employed

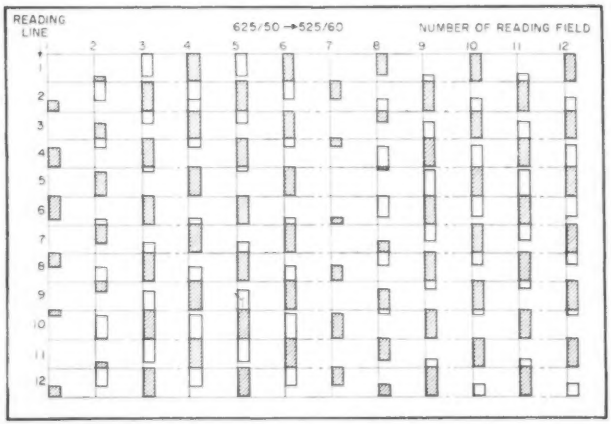


FIG. 9—Picture signal (shaded area) and charge left stored (clear area) for flat object field when single-line-width reading and writing spots are employed

Flicker

All flicker effects could be removed completely if the writing-spot brightness would remain unchanged for an entire writing frame period and would then be corrected to take on its new value. In this case the reading and writing process for a flat object field might be represented, for the transition 625/50 to 525/60, by the diagram in Fig. 10. The broadening of the arrows symbolizes the increase in stored charge in the period intervening between successive erasures by the reading beam. The time relation between the writing process and reading process has here become entirely irrelevant.

The writing portion of such a

conversion system has the basic properties of a storage kinescope, whereas the reading portion may be any pickup system, of a storage or nonstorage type. The usefulness of such a device for standards conversion, as well as the possibility of its realization, have been recognized by Schröter.[3]

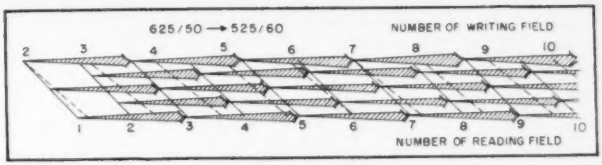


FIG. 10—Relationship between writing and reading process in converter consisting of storage kinescope and storage camera tube (single-line-width reading and writing spots)

Proposed System

In the arrangement proposed by Schröter (Fig. 11) the electron emission is provided by a uniformly illuminated, extended conducting photocathode which is deposited on a perforated insulating sheet. As the insulator is scanned by a medium-velocity constant-current beam, a closely spaced collector grill (or transparent conducting film) is modulated by the writing picture signals. As a result, the insulator spot scanned at any moment tends to assume (by distribution of its secondary emission) the instantaneous potential of the grill.

In this manner an essentially stationary charge pattern is generated on the insulator, changes occurring only as there are changes in the transmitted scene. This charge pattern controls the emission of the photocathode by coplanar grid action—field leakage through the insulator perforations. The remainder of the storage kinescope is essentially an image tube.

Schröter has suggested the transformation of this system into a standards converter by replacing the fluorescent screen by an aperture and multiplier and providing transverse deflecting coils actuated at reading line and field frequency. The reading portion is here simply an image dissector. The instantaneous potential of the grill would influence the photoemission, resulting in a superposition of the writing signals on the reading signals. This would be most serious with the nonstorage (dissector-type) reading section here contemplated, but spurious intensity fluctuations dependent on picture content would occur also if the reading portion of the converter were an image orthicon, provided that a change in field frequency is involved.

There are other systems involving the storage kinescope principle from which this crosstalk could be eliminated. However, the perfection of these devices meets considerable technical difficulties and none of them have been tried so far even on an experimental basis. However attractive they are in principle, they do not constitute a means of solving the problem of standards conversion at present or in the near future. This approach is not neglected; work on the development of new types of standards converters is in progress.

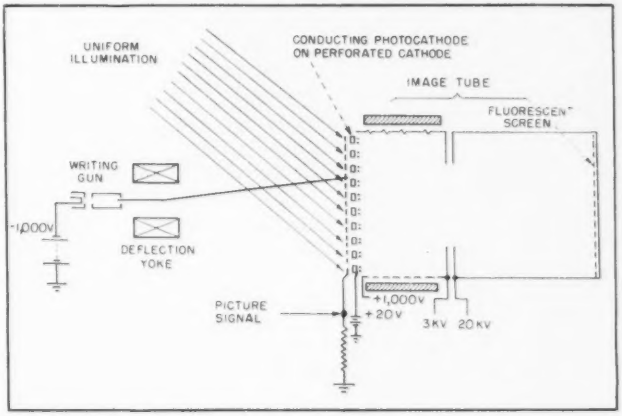


FIG. 11—Principle of storage kinescope (Schroter)

At the present time there are just two methods of standards conversion between systems with different field frequencies:

The intermediate film method, which is fundamentally capable of yielding good results, but will introduce serious picture deterioration unless great care is exercised in controlling the photographic process and the instantaneous method of signal conversion, utilizing a picture tube and camera tube, which inevitably introduces a certain amount of objectionable low-frequency flicker. Storage-tube converters utilizing tubes of known type are subject to the same drawback. The employment of long-persistence phosphors in the kinescope would reduce the flicker effects to some extent; but their practical elimination by this means would also lead to trailing effects on moving objects.

References

(1) D. G. Fink, TV—The International Scene, ELECTRONICS, **23**, p 70, Aug. 1950.
(2) R. V. Little, Television Film Recording, *Broadcast News*, **54**, p 32, Apr. 1949. Also R. M. Fraser, Motion Picture Photography of Television Images, *RCA Review*, **9**, p 202, 1948, and C. G. Mayer, Enregistrement des Images de Television, Congres de Television, Paris, p 182, Oct. 1948.
(3) Y. L. Delbord, L'Enregistrement sur film des emissions de television en vue des echanges internationaux de programmes, Conference Int'l de Television, Zurich, 1948 *Bull. Ass. suisse electr.*, **40**, p 571, 1949.
(4) H. W. Baker and W. D. Kemp, The Recording of Television Programmes, *B.B.C. Quarterly*, **4**, p 236, 1949-50.
(5) A New Television Film Scanner, *Electronic Engineering*, **20**, p 174, 1948.
(6) L. Pensak, The Graphechon—A Picture Storage Tube, *RCA Review*, **10**, p 59, 1949.
(7) A. Cazalas, Transformation des standards en television, *Electronique*, **54**, p 30, May 1951.
(8) F. Schröter, Bildspeicherproblems, Conference Int'l. de Television, Zurich, 1948, *Bull. Ass. suisse electr.* **40**, p 564, 1949.

Tomato Classification

The Agtron, photoelectric bridge spectrophotometer designed for grading tomatoes by color

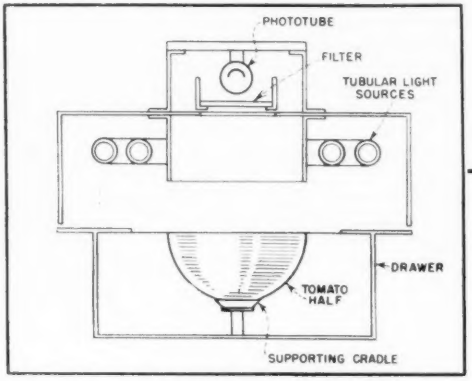


FIG. 1—Cross-section of the light source and phototube assembly for the instrument

By TRAVER J. SMITH and RICHARD A. HUGGINS

Magnuson Engineers, San Jose, Calif.

Huggins Laboratories, Menlo Park, Calif.

WHEN TOMATOES are delivered by the grower to the canning plant they are usually inspected by a state or state-federal inspector for various factors, including color. The grading is based on a random sampling procedure and the tomatoes are classified as well colored, fairly-well colored or cull in accordance with U. S. Government Standards. Disagreements as to grade nearly always concern tomatoes of borderline color.

Tomatoes are graded for color by comparison with specially-prepared color photographs. The inspectors are carefully trained in color comparison and are closely supervised. Work periods are adjusted to avoid eye fatigue and the inspectors are continuously shifted among the many grading stations to assure uniform statewide grading.

With all these precautions, there persists the feeling that grading suffers from human differences between inspectors. These differences can be eliminated through the use of a color-measuring instrument.

Shown in operation in the photograph, the new instrument, the Agtron, was developed especially for tomato inspection by Magnuson Engineers in consultation with Huggins Laboratories. It has been tested and approved by the state and will now be used by California tomato inspectors for precision color grading. With the instrument, tomato grading is quick, simple and positive. Sample tomatoes are cut in two and inspected visually. When the color grade is not immediately apparent, the instrument is used. The two tomato halves are placed in spring-supported cradles and moved into position. Phototubes view them through red and blue filters while the tomatoes are illuminated by low-pressure neon and mercury-vapor lamps. A sketch of the physical setup is shown in Fig. 1.

To adjust for tomato variations, the red reflectance is set to a full-scale meter reading of 100 and then the band selector switch is pressed to give a blue-reflectance reading. The ratio of red reflectance to blue reflectance has been demonstrated to represent the maturity of the tomato. The meter scale is calibrated in red, yellow and green bands to indicate the three classifications of ripeness. These bands were established by correlating numerical scale readings with the average judgment of a number of experienced inspectors.

Color Considerations

Visual color sensations in the human eye are the combined effect of the spectral reflectance of the surface viewed, the spectral energy distribution of the illuminant, the spectral absorption of the transmitting medium and the spectral sensitivity of the eye. In judging tomatoes by eye, the inspector is attempting to evaluate the first factor while the other three factors are subject to probable variations. In addition, his judgment may be modified by the following secondary considerations: surface gloss of the tomato, its size and shape, its internal cell structure, variations in color over the cut surface, direction of incident light, conditioning the inspector has received from examination of previous tomatoes and the contrast between a given tomato and others within view.

Figure 2 shows the spectral reflectance curves of four tomatoes graded as marked. Curve number one is identified as below minimum, fairly well ripened; curve two is

by Spectrophotometry

To eliminate human element in judgment of color, bridge spectrophotometer measures ratio of reflectance at two critical points. Technique is applicable to grading other agricultural products by use of appropriate points on spectral reflectance curves

approximate minimum, fairly well ripened, curve three is approximately minimum, well ripened and curve four is definitely well ripened.

The presence of chlorophyll in the greener tomatoes is responsible for the dip at 680 millimicrons. Curves for relative eye sensitivity and relative daylight energy have been superimposed. Their effect is to modify the tomato curves to the form of Fig. 3 which represents the relative visual stimulation by which one recognizes color difference.

In development of the instrument, the primary objective was to eliminate the many variables discussed and to produce an instrument which would be direct reading and suitable for use by nontechnical personnel. Additional desirable features were that the instrument would not require destruction of the tomatoes beyond cutting in two, it would be portable, rugged, unaffected by weather conditions in open field stations, simple to calibrate and standardize, not susceptible to inaccuracies from varying supply voltage and moderately priced because of the quantities needed. Since production problems are not involved, it is only necessary to grade one tomato at a time. Further, the equipment is not required to serve any other purpose than evaluating tomato color.

The circuit of the instrument is shown in Fig. 4. Selected blue and red reflectance responses, containing 120-cps modulation from the a-c light sources, feed a 6SJ7 followed by half of a 6SN7. Both tubes are a-c amplifier stages. The other half of the 6SN7 is a detector whose output goes to the bridge vtvm formed by two halves of another 6SN7 with the meter connected across the two cathodes. Various types of d-c amplifiers were investigated but were discarded because of their inherent drift and poor stability.

Operation is as follows: Reference to the spectral reflectance curves of Fig. 2 shows that there are two well-established plateaus, one in the 400 to 520-millimicron region and the other in the 640 to 740-millimicron region. Operation is based upon the fact that the ratio of monochromatic reflectances in these two bands forms a dimensionless function which indicates the ripeness of the tomato. Such a function is independent of variations which would affect the absolute spectral response of the instrument. Previously, general proof of a definite relationship between spectral reflectance curves of agricultural products and their maturity had been published by White[1].

Selection of light sources dictated

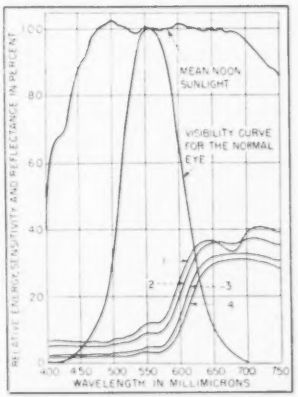


FIG. 2—Spectral reflectance curves for four grades of tomatoes. Normal visibility curve and spectral energy distribution of sunlight have been superimposed

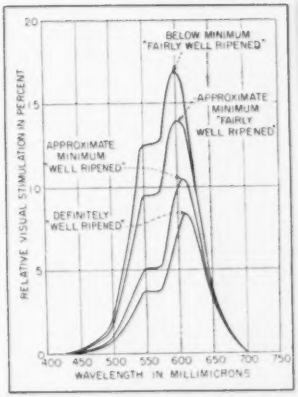

BELOW MINIMUM "FAIRLY WELL RIPENED"
APPROXIMATE MINIMUM "FAIRLY WELL RIPENED"
APPROXIMATE MINIMUM "WELL RIPENED"
DEFINITELY "WELL RIPENED"
RELATIVE VISUAL STIMULATION IN PERCENT
WAVELENGTH IN MILLIMICRONS

FIG. 3—Curves of Fig. 2 as modified by the normal-visibility and sunlight-illumination curves. The curves indicate the color differences the inspector sees

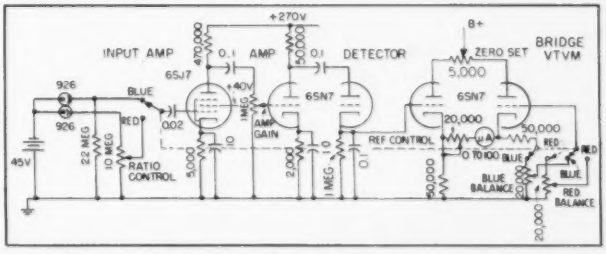


FIG. 4—Circuit of the bridge spectrophotometer includes two stages of amplification and a detector ahead of the measuring bridge

the use of monochromatic elements to eliminate spectral-response differences in phototubes as well as spectral shifts in aging light sources. Use of white light with standard optical filter combinations did not produce sufficient monochromaticity.

The final solution was a low-pressure mercury-vapor arc in conjunction with a Corning number 5113 filter to isolate the 436-millimicron mercury line and a low-pressure neon arc lamp with a Corning number 2412 filter to isolate the 632, 640 and 651-millimicron neon lines. These three dominant neon lines are sufficiently close together to approximate a single line since the tomato curves are flat over this band of wavelengths.

Type-926 phototubes with S-3 spectral response were used because of their good sensitivity in the chosen region.

Grading Procedure

Graphically, the grading procedure may be represented by Fig. 5. First, the unit is set up for use by balancing out the dark current for each color. This is accomplished by using the red-balance and blue-balance controls shown in the accompanying circuit. This operation establishes the baseline along the *X*-axis shown in Fig. 5. The zero-set control in the bridge plate supply is used to adjust for warmup drift. Next, a standard white disk

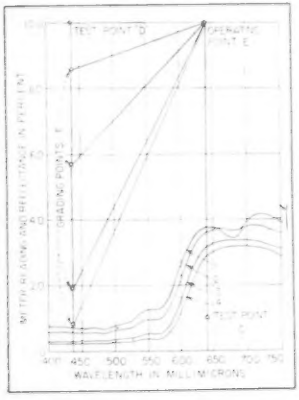
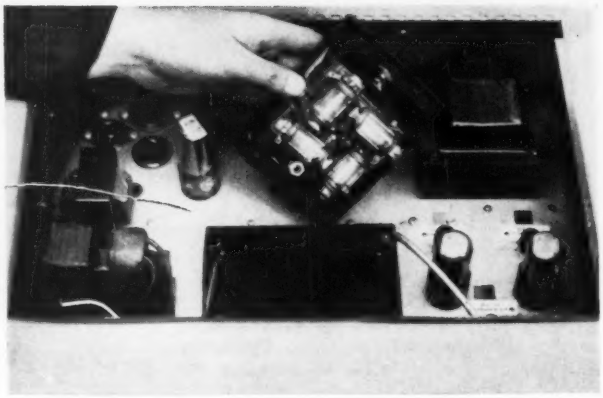


FIG. 5—Graphical representation of tomato grading procedure. Curves 1 to 4 have the same identification as in Fig. 2 and are described in text



Plug-in phototube enclosure projects downward through the chassis above the grading compartment. The inner surfaces of the compartment are finished in black to prevent unwanted spurious reflections. Reference control and band-selection control are on front panel

with equal reflectance in the red and blue regions is inserted in the tomato test position and, using the ratio control shown in the output circuit of the red-response phototube, blue sensitivity is set at 10 times red sensitivity. This establishes test points *C* and *D* in Fig. 5 and provides full-scale sensitivity for the various tomato grades. The instrument is now fully calibrated and ready to grade tomatoes.

During grading, the tomato halves are put in position and the red response is adjusted to read 100 on the meter scale, by use of the reference control on the front panel. This establishes operating point *E* (Fig. 5) for that particular tomato. In effect, this procedure causes the spectral reflectance curves of all tomatoes tested to pass through point *E* regardless of their grade, size, shape or other variables. The amplifier-gain control is originally set so that the reference control will have adequate range for the establishment of point *E* for all grades from well-ripened to cull and for all diameters from two to four inches.

Operating the push-button color selector then switches the ganged control to blue response and the grade of the tomato is read directly on the meter. These readings are represented by the points marked F in Fig. 5. This illustrates the scale spread resulting from the ten-to-one ratio previously established. Grading points *F* range from 8 to 86 on the meter dial while the actual ratios from the spectral reflectance curves produce a range of only 0.086 to 0.185.

The instrument is housed in a deep cabinet with a drawer-type grading carriage. Spring-loaded cups press the halved tomatoes against a reference plane established by crossed fine wires. The inner surfaces of this compartment are blackened to prevent spurious reflections. The phototubes are mounted in a plug-in enclosure, illustrated above. The enclosure projects downward through the chassis deck above the grading compartment. Only the reference control and the red-to-blue band-selection control are brought out to the front panel.

The Agtron weighs 65 lb and has carrying handles. It operates from 115-v 60-cps with built-in regulated power supply, drawing 1.0 ampere.

Successful development of this grading device suggests the practicality of grading many agricultural products in a similar way by utilizing the salient points of spectral reflectance curves.

Reference

(1) David C. White, "Maximizing Color Differences," Stanford University, 1949.

Bibliography

Arthur C. Hardy, "Handbook of Colorimetry," Massachusetts Institute of Technology, 1936.

Ralph M. Evans, "An Introduction to Color," John Wiley & Sons, Inc., New York, 1948.

SINGLE-BAND AUDIO GENERATOR

The complete range from 30 to 15,000 cycles is covered by varying a single resistance. Three-tube device gives choice of two outputs: either 5 volts across 250 ohms or 30 volts across 5,000 ohms. Principles are applicable to equipment for video or l-f

By PETER G. SULZER
National Bureau of Standards
Washington, D. C.

THE device to be described is a simple resistance-tuned sinusoidal oscillator that is capable of covering the audio-frequency range with the variation of a single resistor. This oscillator was developed to meet the need for a circuit providing excellent waveform and constant output voltage without requiring the use of precise, expensive components.

Several types of resistance-capacitance oscillators have been described in the literature. Each consists of an amplifier with either one or two feedback connections. A frequency-selective network is placed in one feedback loop, while an amplitude regulator such as a lamp or thermistor may be placed in the other feedback loop. The condition for steady-state oscillation is met; that is, a net loop gain of unity at zero phase angle is produced.

It is of interest to consider some of the frequency-selective networks employed in these oscillators. Perhaps the first used in such an application is the half-Wien bridge[1] of Fig. 1A. Here a broad maximum, accompanied by zero phase shift, is obtained at the operating frequency. This network, which is placed in the positive-feedback path of the oscillator, requires the variation of two capacitors or two resistors to change the operating frequency for a constant attenuation and constant oscillator output voltage.

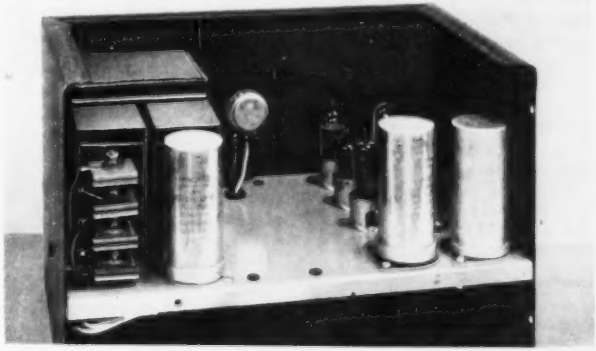
A second network is the twin-T[2], Fig. 1B, which produces a null at the operating frequency. This network, placed in the negative-feedback loop, requires that three circuit elements be varied.

The phase-shift network of Fig. 1C has been employed as an oscillator[3,4,5] in connection with a single-stage amplifier. The oscillator is usually operated at a fixed frequency, since tuning requires a three-gang capacitor or resistor.

Likewise the circuits of Fig. 1D[6,7] and Fig. 1E[8] require ganged capacitors or resistors for tuning. The last network, Fig. 1F, whose application in an oscillator and selective amplifier has been described by Villard[9], consists of two all-pass phase shifters in cascade to provide a total phase shift of 180 degrees at the operating frequency. A single stage of amplification is sufficient to complete the oscillator, and a constant output voltage with variable frequency is obtained by changing both resistors R or both capacitors C. Accurate tracking of these components is not required.

It has been pointed out[7] that variable-frequency operation may be obtained by changing either one resistor or one capacitor. Since all-pass sections are used, a constant attenuation is provided in spite of the fact that different time constants may be employed in the two phase shifters. However, this scheme suffers from two serious drawbacks. If a 10-to-1 (or larger) frequency ratio is required, a considerably larger variation in the variable time constant must be produced. In a practical oscillator this may impose a heavy load on the phase inverter at one extreme of the frequency range, violating the condition (equal but opposite input voltages) required to produce the all-pass structure. A second limitation is that a very nonlinear frequency scale is produced.

Fig. 2A shows the vector diagram used in analyzing the phase-shift networks of Fig. 1F. As mentioned, two equal voltages of op-



Rear view of the complete oscillator with back and top removed. Resistor R in center. Front panel has calibrated dial, gain control and high-low impedance output switch as well as output terminals, on-off switch and fuse

posite phase are applied to the series R-C circuit. A constant-output (all-pass) network is obtained as a consequence of the fact that the voltages across the resistor and the capacitor are 90 degrees out of phase. Thus the locus of the tip of the output-voltage vector is a semicircle as either the frequency or the time constant is varied, providing the load impedance is very high.

In considering the above, the writer was led to question what would happen in such a network if the phase difference between the input voltages were 90 degrees instead of 180 degrees. This is shown in Fig. 2B, where E_A and E_B are the input voltages, E_R and E_C are the voltages across the resistor and capacitor respectively, and E_0 is the output voltage. As before, the locus of the junction of E_C and E_R is a semicircle. However, this semicircle passes through the origin, and hence E_0 experiences a null.

In a practical network the magnitude of E_R, whose phase has been shifted 90 degrees, may vary with frequency. The dashed lines of Fig. 2B show the condition where $E_R > E_A$. It is apparent from the geometry that the production of a null in E_0 is independent of the magnitude of E_R. This fact suggests the practical network shown in Fig. 2C, in which a phase lag of slightly less than 90 degrees is produced by R_1 and C_1. The resistors R_2 and R_3 function as an attenuator to render E_A and E_B approximately equal at the middle range of frequencies. In drawing the accompanying vector diagram it was assumed that R was much greater than both R_2 and the reactance of C_1.

It will be noted that a true null is not obtained, since the phase shift of E_R is less than 90 degrees. However, five interesting points are observed on the vector diagram. Points 1 and 2 produce 90-degree phase shifts in E_0, accompanied by two different degrees of attenuation. At point 3, E_0 passes through a minimum, accompanied by a phase shift between zero degrees and 90 degrees. Point four produces zero phase shift with some attenuation, while at point five E_0 becomes equal to E_A in magnitude and phase.

Suppose that this network is inserted in the negative-feedback path of an amplifier, and also suppose that controlled positive feedback, independent of frequency, is applied. As the positive feedback is increased to where the negative feedback through the network is cancelled, oscillation will commence.

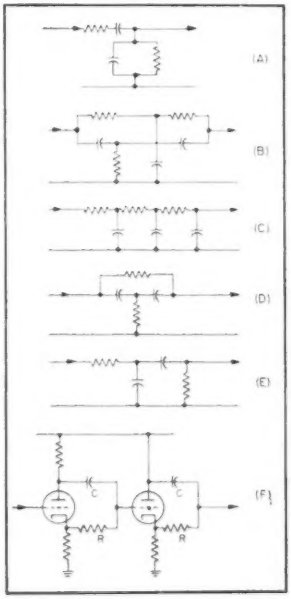


FIG. 1—Frequency-selective networks employed in resistance-capacitance oscillators

Since the condition for oscillation requires zero phase shift, the network must be operating at points 4 or 5. However, oscillations will take place at point 4, since greater attenuation (and less negative feedback) is obtained here. If either R or C is varied, variable-frequency operation will be obtained. As the frequency is varied, however, point 4 will move along the X axis, indicating a change in the magnitude of E_0. This requires a readjustment of the positive feedback, producing a variation of the oscillator output voltage. Fortunately the magnitude and phase angle of E_R vary with frequency in such a manner that the variation of E_0 is partially compensated.

As a final step in the development of the circuit, consider the effect of adding a constant voltage E_A to the output voltage E_0. This is easily accomplished by adding a resistor R_4 in series with the ground terminal of the network, as shown in Fig. 2D. It is seen that the percentage variation in the magnitude of E_0 is greatly decreased.

A typical network shows an attenuation constant within ± 3 percent over the frequency range from 30 to 15,000 cps. It should be noted that the effect of adding such a voltage is to decrease the rate of change of phase of the output voltage with frequency, which would tend to decrease the frequency stability of an oscillator employing the network. This effect has not been found serious.

A simple oscillator employing the network is shown in Fig. 3. Here V_1 is a single-stage pentode amplifier followed by the cathode follower V_2. The frequency-selective circuit is connected in the negative-feedback path from the cathode of V_2 to the control grid of V_1, while positive feedback is applied between the cathodes of the tubes through an attenuator consisting of a variable resistor R_3 and two tungsten-filament lamps.

With the circuit constants shown, a frequency range of 30 to 15,000 cycles was covered with a single rotation of the variable resistor R. The output voltage was constant within ±3 percent, while the waveform appeared good at all frequencies.

The distortion was not measured, but it is presumed to be very low, since the output voltage is stabilized at approximately one-quarter the level at which clipping was observed. Although a maximum output of approximately 20 volts

Bandspreading

The network shown in Fig. 3 covers 30 to 15,000 cycles in one range. Use the values below in microfarads for C and C_1 to cover 20 to 20,000 cycles in three decade ranges.

Frequency range	Capacitor C	Capacitor C_1
20–200 cycles....	0.5	10.0
200–2,000 cycles..	0.05	1.0
2 kc–20 kc.....	0.005	0.1

Resistor R is also changed to a variable 50,000 ohms with fixed 330 ohms.

can be obtained, it is desirable to decrease this to about 5 volts by adjusting R_5.

In covering such a wide frequency range with a single variable resistor, it is observed that the frequency calibration is crowded at the higher frequencies. In some applications, therefore, where precision and resettability are important, an alternate network can be employed. This permits covering the frequency range from 20 to 20,000 cycles in three decade ranges. Suitable circuit values are shown.

Alignment of the oscillator consists principally of obtaining the correct amount of positive feedback. Initially the resistance of R_5 is adjusted to its minimum value, and the plate and heater supplies are connected. The plate voltage of V_1 should be between 110 and 130 volts with the indicated plate-supply voltage. With R adjusted to one-half its maximum value and R_4 adjusted to 500 ohms, R_5 is increased until an output of 5 volts is obtained.

The frequency control R is then adjusted through its entire range, and the output-voltage variation is observed. If the output voltage is not constant, R_4 is changed, and the test is repeated. This may require the readjustment of R_5 to obtain the correct output voltage.

It is felt that the oscillator will fill the need for an economical audio-frequency generator capable of covering a wide frequency range. With a suitable circuit design it should be possible to employ the same scheme at low radio frequencies, and also at video frequencies.

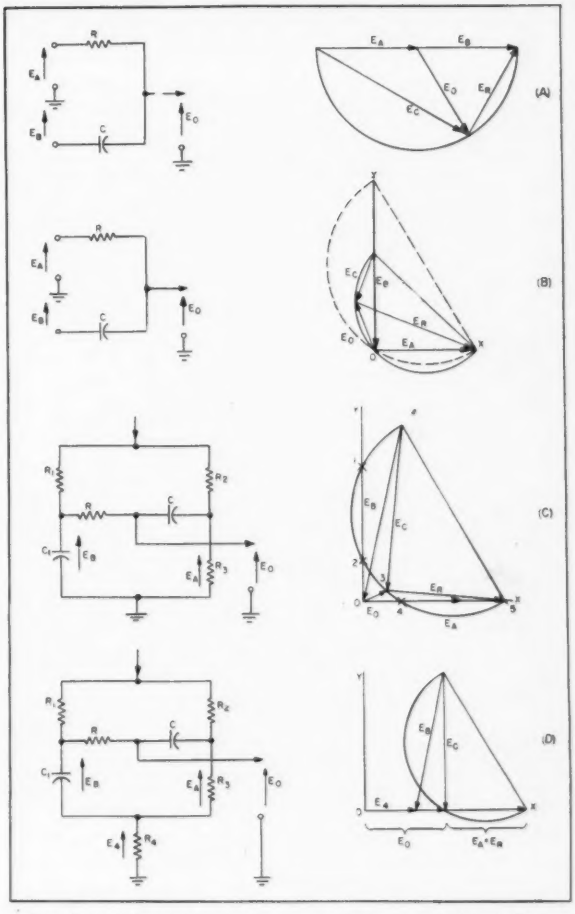


FIG. 2—Steps in deriving the new frequency-selective network described in text

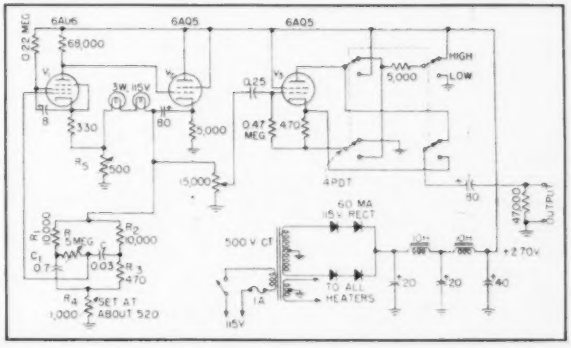


FIG. 3—Complete circuit of the single-resistor (R) oscillator. In low position, maximum output is 5 v at 250 ohms; in high position, 30 v is obtained at an impedance of 5,000 ohms

References

(1) F. E. Terman, R. R. Buss, W. R. Hewlett, and F. C. Cahill, Some Applications of Negative Feedback with Particular Reference to Laboratory Equipment, *Proc IRE*, **27**, Oct. 1939.

(2) Britton Chance, "Waveforms," McGraw-Hill Book Co., New York, p 20.

(3) E. L. Ginzton and L. M. Hollingsworth, Phase-Shift Oscillators, *Proc IRE*, **29**, Feb. 1941.

(4) R. W. Johnson, Extending the Frequency Range of the Phase-Shift Oscillator, *Proc IRE*, **33**, Sept. 1945.

(5) P. G. Sulzer, The Tapered Phase-Shift Oscillator, *Proc IRE*, **36**, Oct. 1948.

(6) P. M. Honnell, Bridged-T Measurement of High Resistances at Radio Frequencies, *Proc IRE*, **28**, Feb. 1940.

(7) P. G. Sulzer, Wide-Range Oscillator, ELECTRONICS, **23**, Sept. 1950.

(8) This circuit has been described in the German and Japanese literature, but a suitable reference is not available.

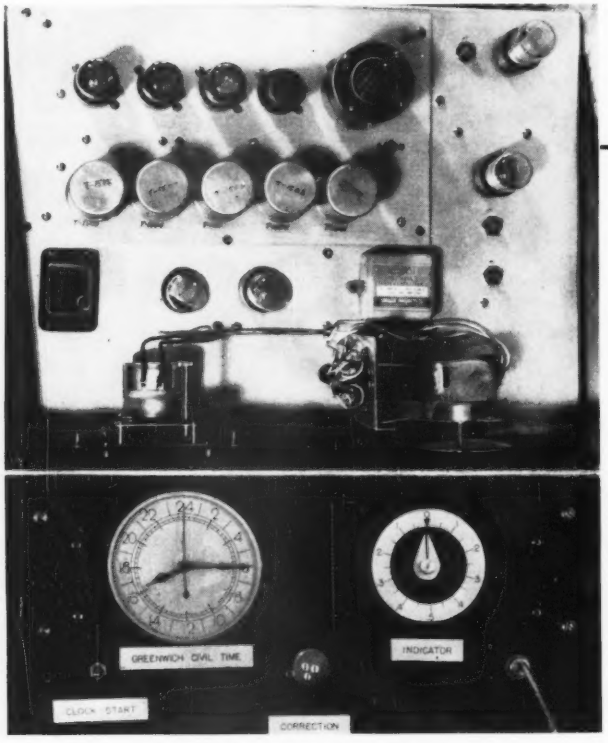
(9) O. G. Villard, Jr., Tunable A-F Amplifier, ELECTRONICS, **22**, July, 1949.

(10) W. G. Ralstrick, Phase-Shift Oscillators, *Wireless World*, **56**, Nov. 1950.

ACCURATE TIME for

By FRED E. FOWLER

High Altitude Observatory of Harvard University and the University of Colorado Boulder, Colorado



Top chassis shows commercial frequency standard built in. Portion of front panel indicates master clock and stroboscopic monitor also shown at top

ESTABLISHMENT of a correlation between natural phenomena of different types is frequently the objective of a research program. Often such a program requires the comparison of data taken independently at a number of observing stations, and in many cases the value of the data may depend upon the accurate timing of the development of a particular phenomenon.

The timing equipment used at the Sacramento Peak Station of Harvard College Observatory is driven by synchronous motors. The device to be described was designed to make possible the accurate operation of exactly synchronized interval timers, exposure timers, and clocks at a number of different stations on Sacramento Peak.

A block diagram of the timing system is shown in Fig. 1. Essentially it consists of a frequency standard that generates a frequency-stable voltage, a phase-shifter to provide a means for correcting the clocks, a power amplifier to drive the clocks, and a monitoring method for indicating time discrepancies between the system and time as given by radio station WWV.

Frequency Standard

The frequency standard shown in the block diagram is a commercial unit built by the Ernst Norrman Laboratories. This unit consists of a temperature-controlled quartz crystal working at a frequency of 90.72 kc. The crystal oscillator is followed by the frequency dividers necessary to give a 60-cycle output. In terms of time, this unit has a stability of better than ± 0.1 second in 24 hours.

Clock Correction

When several clocks or timers are to be driven in the timing system, means must be provided for making corrections simultaneously to all of the clocks and timers on the line.

One method of clock correction is to switch the input to the power amplifier to a frequency several cycles above or below 60 cycles'. Thus the operator can increase or decrease the speed of the clocks until the desired time correction is accomplished. This method was tried in a breadboard model of the timing system, but it was not always possible to get identical response from the different rotors driving the clocks as the frequency was switched during correction.

It appears that if the switching takes place at a critical point in the phase relationship between the two frequencies involved, differential errors between clocks may be introduced by small differences in the mechanical and electrical characteristics of the motors. If such an error occurs, the differential rotor displacement usually will be one pair of poles, which results in a time error of one-sixtieth of a second. Therefore, there is the possibility that after a number of corrections have been made, a significant differential error may be accumulated in the system.

To check the magnitude of any differential errors introduced into the system, the gear boxes and cover plates of the synchronous motors used to drive the clocks and timers were removed. Reference marks were placed on the exposed rotors and the operation of the motors was observed in the light of a

Scientific Observations

Exact synchronism of all clocks, interval and exposure timers driven by synchronous motors depends upon a crystal-controlled 60-cps source with stability exceeding ±0.1 second in 24 hours. Phase splitter and selsyn permit resetting to WWV ticks at any moment

Strobotron lamp fired at the frequency of the power applied to the motors.

Before applying power to the motors, the rotors were positioned manually so that all of the reference marks were in the same direction. Rotor displacements that appeared after power was applied indicated the differences in time required for the individual rotors to reach synchronous speed. Differential errors due to the introduction of a correction signal were observed as further rotor displacements.

Three groups of motors were used in the tests. Each group consisted of motors identical in model and manufacture. Two of the groups comprised motors of the hysteresis type while the motors of the third group were of the inductor type. In each case it was found that differential errors could be introduced.

Phase-Shift Method

To overcome the difficulties observed with the correction method just described a phase-shifter is used instead to apply the corrections to the clocks and timers. The operation of the phase-shifter may be understood by referring to the circuit diagram, Fig. 2. The output of the frequency standard is connected to the primary of T_1. The primary of the transformer is resonated to improve the waveform of the voltage from the frequency standard.

The secondary of this transformer drives a resistance-capacitance network that provides three voltages of equal amplitude but separated in phase by 120 degrees. Each of the three voltages is applied to the grid of a cathode-follower. The outputs of these cathode-followers, V_{1a}, V_{1b} and V_{1c} are used to drive the three stator windings of a selsyn. Therefore, if the selsyn rotor is turned through one revolution the voltage at the rotor is progressively shifted in phase through 360 degrees with respect to the voltage at the output of the frequency standard.

Shifting the phase through 360 degrees will add to or subtract from each clock rotor, depending upon the direction of the phase-shift, a displacement corresponding to one pair of poles. Thus, one rotation of the phase-shifter will apply a correction of one-sixtieth of a second to the clocks. To prevent corrections from being applied at a rate that the clock rotors could not follow, a mechanical damper is fastened to the selsyn shaft.

Amplifier

The output of the selsyn is amplified by V_{2a}, V_{2b} and V_{2c}, and used to drive a cathode-loaded power amplifier. The regulation of the power amplifier is such that timers may be connected or disconnected across the output without requiring adjustments at the amplifier. This feature is of convenience to the operator when the timers are used intermittently and when the timers are located beyond reach of the control panel. The amplifier shown in the diagram furnishes power to the frequency monitoring stroboscope disk, a panel clock, and three additional clocks or timers. This output is sufficient for the central observing position at Sacramento Peak.

The cathode-follower V_{3a} provides a low-impedance, low-voltage output so that the standard frequency and corrections may be transmitted to other observing positions. Additional power amplifiers are supplied at the receiving end of the signal line.

Frequency Monitoring

The frequency is monitored by using the once-per-second ticks of WWV to fire a Strobotron lamp placed behind an aperture in a rotating disk. The disk is driven at one revolution per second by a synchronous motor connected across the clock line. Errors in time that result from frequency deviations from the 60-cycle rate are shown by the shifting in position of the aperture with respect

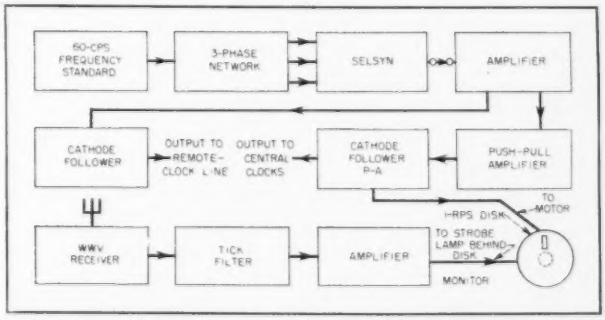


FIG. 1—Elements of the standard time-clock system show dual outputs for local clocks and remote line, stroboscopic monitor to check with WWV and selsyn reset control

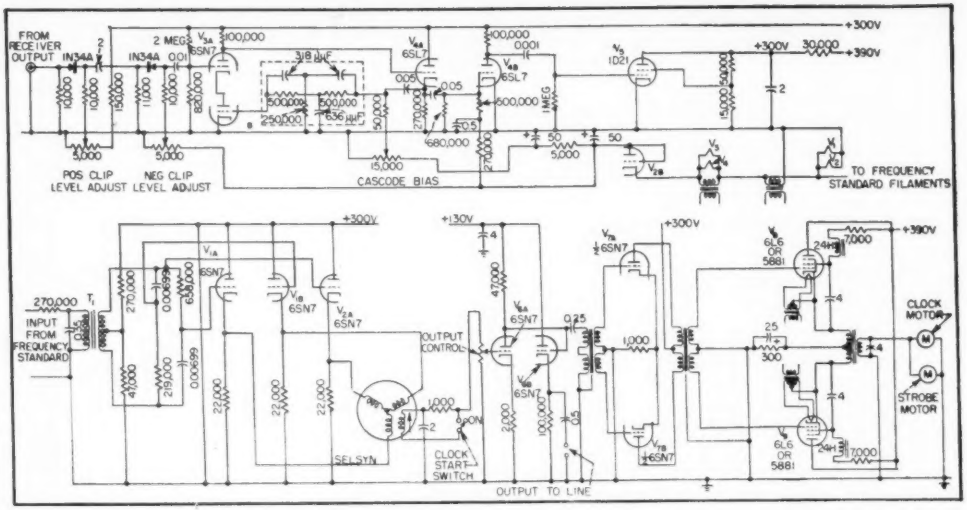


FIG. 2—Features of the timing system include clipping and filtering circuits (upper part of drawing) so that discrete time ticks from WWV allow resetting with great accuracy; and phase splitter for selsyn reset

to the firing time of the lamp.

To remove modulation components other than the 1,000-cycle tick from the audio output of the receiver tuned to WWV, a clipper and a 1,000-cycle filter are used. The clipper consists of two 1N34 diodes that clip both the positive and negative sides of the receiver output to prevent noise pulses from firing the Strobotron lamp.

A parallel-T resistance-capacitance null network in a feedback loop is used for the 1,000-cycle filter. Tubes V_{2A} and V_{2B} are operated in a cascode arrangement. The signal from the clipper is applied to the upper grid while the feedback through the parallel-T is applied to the lower grid. A cathode-follower V_{4A} completes the feedback loop.

The cathode-follower also drives the amplifier V_{4B}. This stage is biased to cutoff so that a large negative pulse is produced with each incoming tick. These negative pulses cause the Strobotron lamp V_5 to fire once each second. Tube V_{2B} is a rectifier that furnishes the negative bias for V_{4B} and the clipper.

To place the equipment in operation, all the clocks are preset for a WWV time signal. The second hands of the clocks and the stroboscope disk are all set to zero. When the time signal is given, the operator throws the clock-starting switch that applies drive to the power amplifier.

The motors used throughout the system reach synchronous speed within two cycles of the applied voltage. This characteristic limits the differential starting time error to less than this value. The error due to the operator's reaction time in throwing the switch may be corrected by rotating the phase-shifter until the stroboscope disk is at the zero position.

Errors that accumulate owing to frequency drifts in the standard oscillator are indicated by a shifting of the position of the aperture of the stroboscope disk with respect to the firing time of the lamp. These errors are also corrected by rotating the phase-shifter. Since the correction system does not introduce differential errors between clocks, the equipment may be left in operation until maintenance is required.

The monitoring disk may be calibrated so that the displacement of the aperture from the zero position may be read directly in terms of error in time. Since the number of rotations of the phase shifter to correct any given error is known, it is a simple matter to reduce the error to zero. It is possible, therefore, to make corrections even when extremely adverse radio reception conditions permit only occasional ticks to come through. Since an error of one-sixtieth of a second results in a shifting of the stroboscope aperture of six degrees, the limit of the indicating system is approximately the same as that of the differential starting error, and this is the available accuracy

The electronic components of the system are housed in a standard two-deck cabinet. The top chassis contains the circuits of the frequency standard, the phase-shifter, and the stroboscope. The amplifier and power supply are mounted on the bottom chassis. These units and a front panel view of the instrument are shown in the accompanying photographs.

The instrument was designed and constructed for Harvard University by the electronics group of the High Altitude Observatory. Members of the group are R. H. Lee, J. C. Palmer, D. S. Johnson, and the writer. The work was sponsored by the Geophysical Research Division of Air Force Cambridge Research Center under Contract W19-122ac-17.

Reference

(1) J. H. Greenwood, Accurate Time for Broadcast Studios, Electronics, p 97, June 1951.

Magnetic Centering of Electrostatic C-R Tubes

Pictures on the new electrostatically-focused tubes can be centered by one of three different p-m devices—the rotatable magnet, the contrarotatable magnet or the offset ring. Design and adjustment procedures of three basic types are shown

By S. L. REICHES and D. P. INGLE

Engineering Department
All Star Products, Inc.
Defiance, Ohio

ELECTROSTATICALLY-FOCUSED picture tubes require some separate centering means since the usual centering methods of moving the entire focus unit in the e-m case and the slide pole piece in the p-m case are not available. The new device used to accomplish centering on the electrostatic tube is called the centering unit and at this time there are three distinct types available. While there are many variations among the three basic types, all being mechanical or material differences, this paper is confined to a typical example in each group.

Early in the development of the electrostatic tube, using the so-called deceleration lens, it was recognized that the quality of focus is sensitive to the maintenance of a high degree of concentricity between the electron beam and the elements of the electron lens. In addition, it was found that the dot is readily distorted into the astigmatic shape or the comma when the beam traverses a magnetic field placed between the ion trap and the deflection yoke if this field is not uniform to a high degree. While it was found that the sensitivity of the beam to these distortions varied with the make of the tube, all tubes suffer to a more or less degree. In addition to the variation between tubes of different manufacture the type of ion trap used was also found to have an effect on the degree of nonlinearity that can be tolerated in the magnetic field.

This information showed that any

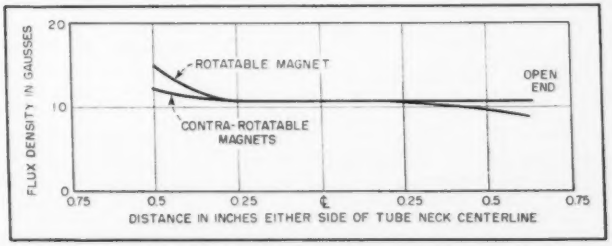


FIG. 1—Curves show linearity of flux distribution across neck of tube

FIG. 2—Plug and flux meter setup used to make field measurements on ion traps and centering units

magnetic device placed between the ion trap and the deflection yoke for centering purposes must have, as a first requisite, a uniform field in the area of interest and should not have a field component parallel to the electron beam since this field will produce some magnetic focusing which is not desired.

The amount of centering motion considered necessary has been decided upon by consultation with tube manufacturers. While most manufacturers feel they will be able to hold the beam within one inch of the center of the face of the tube it is felt that about 2½ to 2½ inches total displacement should be made available.

Basic Types

The three basic types of centering units may be classified as: The rotatable magnet, contrarotatable magnet, and the offset open ring magnet type.

The rotatable magnet type is based upon the principle that an electron beam will be displaced with minimum distortion as to size and shape when it is passed transverse to a uniform magnetic field. The amount and direction of this displacement is determined by the strength of the field and its direction.

In the rotatable magnet design the control of flux density and field direction is achieved by arranging a magnet that can be rotated between two pole pieces which surround the neck of the tube and between which the electron beam passes in the general manner of the ion trap.

The usual ion trap shape pole pieces can not be used since the flux distribution along the axis of beam displacement is very nonlinear. The measuring technique used in the development of linear flux distribution pole pieces is the same as used in the development of ion trap pole pieces. Figure 1 shows measurements made on two types of centering units along the axis of beam displacement. The ion trap flux distribution is far from the desired linear distribution, as proved by tests on various ion trap types currently being used. Figure 2 shows the plug used for field measurements on both the ion trap and the centering unit as used in conjunction with a General Electric gauss meter.

Rotatable Magnet

The mechanical design of the rotatable magnet unit begins with a small magnet mounted on a shaft with an associated bearing. The magnet is positioned between the pole pieces, which are also used to mount the unit to the neck of the tube as is shown in Fig. 3. The magnet size is such that a field of about 9 gausses is developed at the center of the arcuate section of the pole pieces. As the magnet is rotated from this position the flux goes through zero and then reaches 9 gausses again but with the direction of the field reversed from the original direction. Adjustment of the picture when one of these units is used alone consists of rotating the entire unit around the neck of the tube until the long axis of the device (the one that passes through the magnet) is lined up with the polar axis of displacement of the picture. The magnet is rotated and the picture moves along the polar axis until it is centered.

Some manufacturers prefer to make provision for external control of centering. One in particular has taken advantage of the fact that he has always carried some d-c in the horizontal windings of the deflection yoke. This current is made controllable and is used for horizontal centering. A rotatable magnet type of unit provides the vertical centering and external control is achieved by adding an extension to the magnet shaft which then extends out the back of the set. The other solution, the more general among those requiring external control, has been to arrange two of the rotatable magnet units at right angles to each other and one behind the other. (The one producing the horizontal displacement is closest to the deflection yoke.)

It is possible to combine the two right-angle units into one assembly but the economics are such that nothing is saved by doing so while the magnet problem becomes quite troublesome.

Of prime importance in all units is the choice of magnet material. The highest coercive material economically available should be used. This is necessary since like the ion trap and the p-m focus unit the device is operating pretty much under open-circuit conditions and thus is subject to self-demagnetizing effects. In addition, in the case of centering devices, due to operating them so close to the deflection yoke, heavy demagnetizing effects by the field from the deflection yoke also exist. In the event an anastigmatic type yoke is used, the demagnetizing can be really serious. As an example, one device tested before installation measured 11 gausses. After exposure to the field from the anastigmatic yoke this dropped to 6 gausses. Because of this, the rotatable magnet type uses a small piece of Alnico V to minimize this problem.

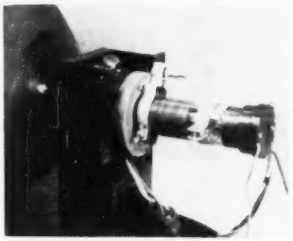


FIG. 3—Rotatable-magnet type centering unit

Contrarotatable Magnets

The second basic type of centering control, the contrarotatable magnet design, is shown installed on a tube in Fig. 4. This unit consists of two open ring magnets of either Cunife or piano wire. They fit into two aluminum supports (the pieces with the ears) and the whole assembly is held together by a fiber ring.

The entire unit is held on the neck of the tube by the spring tension afforded by a brass strap that curls inside of the fiber assembly ring.

While this unit looks radically different from the rotatable magnet centering unit, the principles of operation are similar. The two ring magnets, with the diameter larger than the neck of the tube, in addition to being magnets provide the equivalent of the pole pieces of the rotatable magnet unit. Being an-

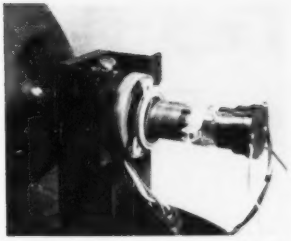


FIG. 4—Contrarotatable unit consists of two open ring magnets

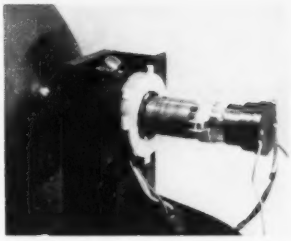


FIG. 5—Offset open ring magnet centering device

nular and of homogenous magnetic construction it is found that the flux distribution along the axis of beam displacement is uniform and as good as the rotatable magnet device. Control of magnetic flux density is achieved by rotating one ring magnet with respect to the other. This is done by using the ears on the aluminum pieces as purchases.

When the openings of the ring magnets are opposite one another and each tip of the same polarity the strongest field is produced. When one magnet is rotated, with the other held still, when the openings are opposite each other again, the magnetic flux is at a minimum. Therefore, by rotating one magnet with respect to the other the flux changes from maximum to minimum, and the beam will displace.

If the openings on the ring magnets are on the wrong side of the tube, it will be found that the beam will displace more in the undesired direction. When this occurs the unit need only be rotated through 180 degrees and the rings again rotated with respect to each other until centering is achieved.

In use, this unit is best handled by orienting the openings of the ring magnets along the axis in the same manner as the magnet of the rotatable type was oriented, and one ring rotated with respect to the other. If this moves the picture in the wrong direction, the entire unit should be rotated through 180 degrees and the rings again displaced.

No convenient method exists to date for providing external control with this type of device which limits it to the serviceman's type of installation. Designs other than the one shown have more positive methods of maintaining the position of the unit on the neck of the tube. One design affords a means for clamping by a screw arrangement similar to the type used on the rotatable magnet unit shown above.

The use of low-coercive magnetic materials, like carbon steels, in an area where strong a-c fields exist, such as in back of the deflection yoke, seems to merit further consideration. One type of contrarotating magnet design uses Alnico V which will undoubtedly be trouble free.

One of the major limitations to this type unit as compared with the rotatable magnet design, is that in spite of relation between magnet position and beam displacement described above, in production and in the field, there are no positive indications between the unit and what a change in the unit will do to the beam.

In the rotatable magnet design, there is a definite and easily-spotted relationship between the position of the unit and what a rotation of the magnet will do to the beam position. This represents a material time savings in final adjustment and inspection in production in addition to helping the worker in the field, whether set owner or serviceman. The amount of centering and the amount of dot distortion produced by most of these units is comparable with the rotatable magnet type.

Offset Open Ring

The third method for centering the picture is the offset open ring magnet. This device consists of one open ring magnet similar to those used in the contrarotatable magnet design except that the ring is larger in diameter. As can be seen in Fig. 5 this ring magnet is mounted on a support in such a manner that it can be rotated about the neck of the tube and also moved transversely with respect to the electron beam axis. Thus by moving in some combination of these two displacements some centering can be achieved.

The method of mounting this device may be seen in Fig. 5. Three ears grasp the cap cover of the deflection yoke sufficiently well for all practical purposes. In addition to the limitations of the contrarotatable magnet device, the only units examined to date are quite limited as to the amount of displacement to the point that their use on electrostatic tubes is debatable.

The contrarotatable types using low-coercive magnet material are not as desirable as these using Alnico V. In either case it is felt that the most desired unit in this group is one with Alnico V magnets and provision for clamping other than spring tension. While spring tension is certainly adequate for ion traps, a clamp is believed necessary in the centering device not only to prevent rotation around the neck of the tube but to insure against twisting of the centering unit. In addition to a good clamping means this requires adequate width of the part that is arcuate with the neck of the tube.

Present Status

At this time, the only rotatable magnet type in use is the one shown in Fig. 3. This unit uses Alnico V (less than 1th oz) between properly-shaped pole pieces to insure a high degree of field uniformity. The unit is held in place, once it has been positioned, by a screw and wing nut. The pole piece width is about 0.5 inch preventing any twisting of the unit. Movement of the picture by this unit is directly correlated to movement of the magnet and to the unit as a whole thus eliminating cut and try centering. External control of centering is available if desired.

The rotatable magnet type has the further advantage that it can be used on tubes that require little or no centering correction. The contrarotatable type cannot provide low or zero flux in most cases.

Tunable

By D. A. WILBUR, P. H. PETERS
and H. W. A. CHALBERG

General Electric Company
Electronics Park
Syracuse, New York

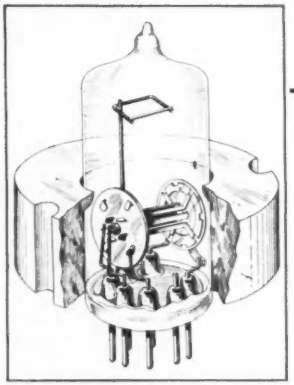


FIG. 1—Cut-away drawing of miniature magnetron shows interdigital construction. A permanent magnet furnishes the required field of 500 to 600 gauss

MAGNETRON OSCILLATORS, well known for their high-power microwave performance, may be constructed on a miniature scale to serve as efficient local oscillators delivering high-frequency c-w energy at levels in the order of one-half watt. Experiments show that such magnetrons are quiet in performance, having carrier-to-rms noise ratios equal to those of an ordinary triode oscillator.

Although conventional triodes are readily available for local oscillator service below 500 mc, their performance above this frequency, in the proposed uhf-tv range of 475 to 890 mc for example, is marginal. In particular, at frequencies much above 500 mc triode dimensional tolerances and element spacings become critical and result in relatively expensive tubes.

On the other hand, a magnetron of the so-called interdigital type is structurally a simple multi-anode diode having relatively large spacings and tolerances between elements. As an oscillator its circuit is inherently simple since no external provision for feedback is required. Efficient operation at the 900-mc end of the spectrum may be attained with comparative ease since the magnetron, operating in the travelling-wave mode, utilizes the effect of electron transit time beneficially in its production of oscillations. It is also possible to generate frequencies as low as a few cycles per second by operating it as a negative-conductance oscillator.

As a result of these considerations a new inexpensive miniature magnetron has been developed to cover a frequency range from 0 to 1,000 mc and to deliver r-f powers in the order of one-half watt or less. Its experimental designation is Z-2061.

Tube Structure

A cut-away drawing of the new magnetron and its associated ring magnet is shown in Fig. 1. Mounted on a standard 7-pin miniature base the anode structure is of the interdigital type and consists simply of eight vanes anchored alternately to two end rings so that four vanes are connected to each end ring. Two mica spacer disks are used to secure the vane assembly and to center an axially-located indirectly-heated oxide cathode.

A permanent magnet with a field strength in the order of 500 to 600 gauss is used to supply the magnetic field. Magnetization is transverse to the cylindrical axis of the magnet. Nonmagnetic material is used for the vanes and supporting rings to assure uniform flux density over the entire anode-cathode interaction space. The T-5½ bulb diameter reduces the magnetic path length in air to a minimum. To minimize hum modulation a reverse coil heater has been used.

D-C Characteristic

To measure the static behavior of the miniature magnetron, both sets of vanes are connected to a common positive d-c potential, and in the absence of oscillations, the static anode current is found to vary as shown in the curves of Fig. 2. Simple theory predicts that for any fixed magnetic field strength a cutoff voltage exists below which no anode current will flow. However, there is always some leakage current below this cutoff voltage in all magnetrons and the relative effect of two different field strengths in minimizing this leakage current is shown in Fig. 2.

The diode leakage current is seen to be as high as 18 ma at 160 volts and 600 gauss. This leakage current below the cutoff voltage has been found especially useful in its

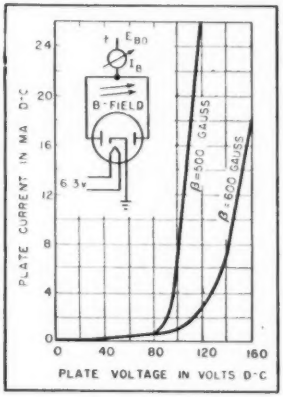


FIG. 2—Typical static plate characteristics of miniature magnetron

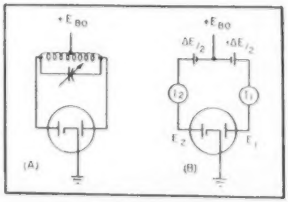


FIG. 3—Circuits for low-frequency oscillator and for measuring negative conductance of miniature magnetron

Miniature Magnetron

Tube designed for use as local oscillator in uhf receivers fits miniature 7-pin socket and provides outputs up to 0.5 watt over a frequency range of zero to 1,000 mc. Stability is good and associated circuitry is extremely simple

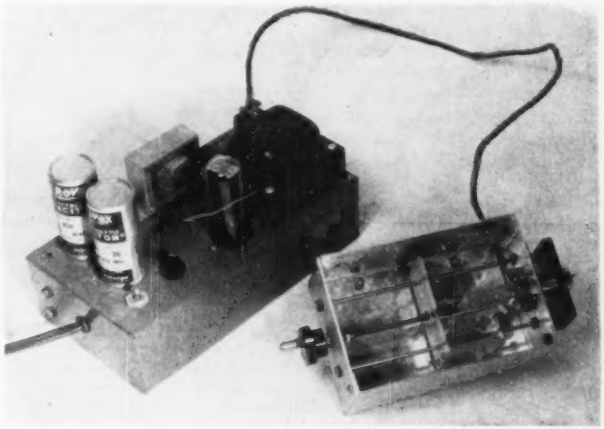
effect on the starting characteristics, as will be described later.

Types of Oscillations

If the terminals of a frequency-determining circuit are connected in push-pull fashion to each anode set, as shown in Fig. 3A, and the voltage raised from zero upward, oscillations at the circuit resonant frequency will occur. Two general types of oscillation can be produced depending on the operating voltage and resonant frequency. One type of oscillation utilizes a static negative conductance existing between adjacent anodes to sustain oscillations. The voltage and field strength need merely be set at a static operating point about which the negative conductance is sufficient to compensate circuit and load loss. Operating voltages for this mode are kept large enough so that the electrons complete their work on the r-f field as they cross under only one gap before being collected by the most negative vane, and they therefore move at velocities greater than required for synchronization with the r-f field alternations.

The highest frequency possible for a given voltage is determined when the duration of one-half r-f cycle becomes comparable to the transit time of electrons in passing from one vane to the next. Although the anode voltage can be increased to raise this frequency limit somewhat, the diode leakage current soon loads the tank circuit so heavily that oscillations are no longer generated. For the voltage, magnetic field, and geometry of the tube, the negative-conductance effect seems best suited for power generation below 100 mc.

Above 100 mc, a second type of oscillation is brought into action.



Magnetron tuner and power supply for continuous tuning from 515 to 930 mc

This type, called the travelling-wave mode, is most commonly employed in present day uhf magnetrons and utilizes to advantage the effects of transit time. Instead of attempting to maintain electron velocities much faster than required for synchronization with the anode r-f voltage, the electrons are made to rotate about the cathode in synchronism with the r-f voltage on the tank circuit. The electrons being in step with the r-f field deliver energy to the tank over several r-f cycles, crossing under several vanes before collection takes place.

For a given frequency the operating voltage is much lower than that required for negative-conductance oscillations and energy transfer is more efficient. The voltage must, however, be sufficient to synchronize the electron angular velocity with r-f field. As a consequence there is a minimum starting voltage for each operating frequency in the travelling-wave mode.

It is found that for a given anode voltage, a gradual transition from the negative-conductance type oscillation to the travelling-wave type oscillation takes place as the operating frequency is increased. For voltages near the cutoff voltage, there is evidence that the negative conductance action remains effective well into the uhf range.

Oscillations at UHF

In investigating the operating characteristics of the Z-2061 particular emphasis has been given to operation in the uhf portion of its range as regards power output, noise level, frequency stability and efficiency.

In Fig. 4 are shown the characteristic curves for 600 gauss which result for oscillating frequencies between 400 and 950 megacycles. The tube is acting as a travelling-wave magnetron and, as the voltage is raised from zero, only leakage current is drawn by the anodes

until the proper synchronizing voltage is reached, at which point oscillations begin. A further increase in voltage results in a rapid increase in anode current as the r-f energy stored in the tank circuit increases. Depending on the loading of the tank circuit, the rate at which anode current builds up with increasing anode voltage may be more or less rapid and the slope of the dynamic oscillating curves will be altered correspondingly. Light loading results in large r-f voltages and large current collection at the anodes. Heavy loading restricts r-f vane-to-vane voltage and the d-c collection grows less rapidly with applied d-c voltage. The curves of Fig. 4 correspond to particular loading conditions obtained in a turret tuner to be described in a later section, but they are representative of the behavior to be expected with typical uhf circuits.

Referring again to Fig. 4, suppose oscillation is taking place at 700 mc. This corresponds to an operating point of 10 ma at a fixed voltage of 100 volts. If the tank circuit is tuned downward to 500 mc, the anode current will rise rapidly until it reaches about 32 ma which is considerably above normal rated current. Continued lowering of the operating frequency finally causes the electrons to fall out of step with the lower radio frequency being generated. Then the oscillations abruptly stop. Restarting can be accomplished only by lowering the voltage to the 500-mc starting level of about 70 volts or by raising the tank frequency upward again toward 700 mc.

If we retune to our original oscillation at 700 mc and now tune the tube upward in frequency, the anode current drops until at about 750 mc, oscillation ceases and the current consists merely of the diode-leakage component given by the static plate characteristic.

These processes indicate that considerable adjustment of the anode voltage is required to maintain optimum r-f power over a two-to-one frequency band. For operation of the magnetron over a wide frequency range from a fixed voltage supply a series resistor in the anode circuit provides a satisfactory self adjustment of the anode voltage. In Fig. 4 is shown a load line for a 10,000-ohm series resistor and a supply voltage of 300 volts d-c. With this value of resistance the magnetron will run at a reasonably uniform current level near 20 ma between 400 to 950 mc and the anode voltage will be automatically adjusted from 85 to 125 volts over that tuning range.

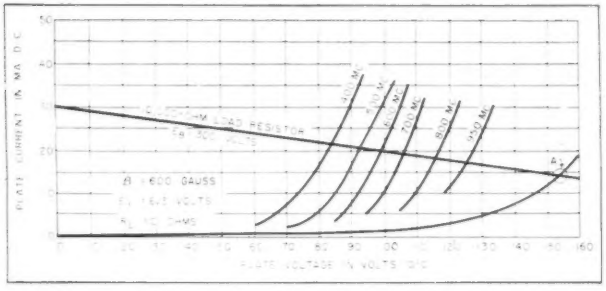


FIG. 4—Stable dynamic plate characteristics for 400 to 900-mc turret tuner

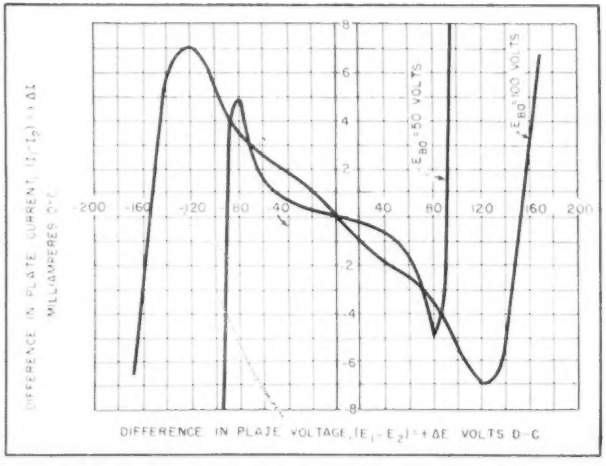

DIFFERENCE IN PLATE CURRENT (I1-I2)+ΔI MILLIAMPERES D-C
DIFFERENCE IN PLATE VOLTAGE (E1-E2)+ΔE VOLTS D-C
E80=50 VOLTS
E80=100 VOLTS

FIG. 5—Negative-conductance characteristic for 600-gauss field

Oscillation Stability

The two ends of each dynamic curve in Fig. 4 define a stable voltage range over which the oscillations at each respective frequency are stable with respect to loading out. While oscillations will continue for currents much higher than defined by the high-current end points in Fig. 4, they will not restart when once loaded out. Within the boundaries of these curves, oscillations will start again upon removal of the load.

For example, suppose at 400 mc the anode voltage is momentarily raised above the top stable point of 95 volts and 37 ma. If the tube is now loaded out of oscillation, it will not restart again until the voltage is reduced so as to be in the 400-mc stable voltage range. On the other hand, if the voltage is made less than 60 volts, of course, oscillations will not commence in the first place.

Addition of the series resistor modifies the loading-out and restarting behavior. When the oscillator is loaded so as to stop oscillations, the anode current and the voltage across the series resistor will drop, as the anode voltage rises to the point where the static characteristic intersects at point *A*. This corresponds to an anode voltage and leakage current of about 154 volts and 14 ma.

It would be presumed, therefore, that unless the supply voltage itself were lowered to the stable voltage range corresponding to the tank setting, oscillations could not begin again even after load removal.

However, in practice, the tube will begin to oscillate again even though its anode voltage is far in excess of the proper synchronous voltage. Restarting occurs because of the negative conductance which exists between the anodes at the 154-volt and 14-ma level. This negative conductance is described in detail in the discussion of class-A oscillations. As the oscillation amplitude increases it causes an increase in anode current and a decrease in anode voltage along the series-resistor load line. In turn, the decrease in anode voltage occasions a reduction in the available low-level negative conductance. However, for a given d-c anode voltage, the negative conductance is greater for large r-f signals than it is for small. Consequently, oscillations once started at point *A* quickly become large enough to sustain themselves even though the d-c anode voltage falls well below the 154-volt level. Ultimately this voltage falls low enough for the electrons to synchronize and generate travelling-wave oscillations. The voltage and current then stabilize at an intersection of the load line and one of the curves.

Low-Frequency Oscillations

Although the Z-2061 has been designed principally as a high-frequency oscillator, measurements show that it will generate considerable power in lower frequency bands, including the audio range. Operation from a few cycles to approximately 100 mc is of the negative-conductance type.

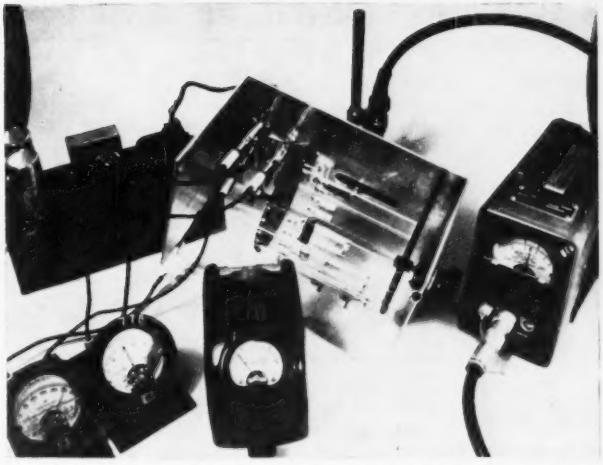
This negative conductance is exhibited between the two anode sets and may be measured by applying an incremental positive voltage to one anode and an equal but negative voltage to the other with respect to a quiescent d-c level, as illustrated in Fig. 3B. It is observed that while current to the slightly positive anode will increase slightly, the current to the less positive anode increases far more. Consequently, the difference current through an impedance connected between the anodes will appear to flow toward the anode that is least positive, a condition indicating negative conductance.

If the incremental voltages are applied in opposite sense, the anode which had formerly been most positive will be least positive and will be collecting the most current. In Fig. 5 are shown relationships between incremental difference current and differential anode voltage for two quiescent voltage levels. For example, a +40-volt differential means that +20 volts has been applied to anode 1 and −20 volts to anode 2. The resulting current change is negative indicating a positive current flow away from anode 1.

Class-A Oscillations

As the quiescent level is increased toward the cutoff voltage of 160 volts at 600 gauss, the negative conductance continues to increase. At 150 volts it has been measured as −312 micromhos, whereas at 100 volts it is only −50 micromhos. Of particular interest is the fact that the negative conductance is appreciable for very small incremental voltages about any given quiescent point, when the quiescent voltage is a relatively large fraction of the cutoff voltage. The oscillations generated by this type of operation can start from noise level. Such oscillations are only about five percent efficient, and may be classified as being developed under class-A operation of the tube.

More familiar is a second type of negative-conductance oscillation which compares with that developed by a class-C triode oscillator. The 50-volt curve of Fig. 5 is suitable for such oscillations. For a typical loaded tank circuit the conductance at the origin is too low to build up oscillations from noise. If a surge across the tank can be established in the order of 50 volts, when the tube is turned on, sufficient power will be delivered to the tank at the



Turret tuner uses six tuner strips of the type shown in Fig. 6 and can be adjusted for any six frequencies between 400 and 1,000 mc

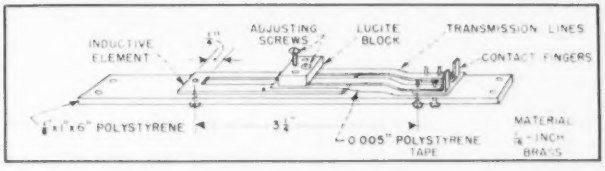


FIG. 6—Drawing of tuner strip for coverage of frequency range from 500 to 600 mc

Table I—Typical Oscillator Data for the Miniature Magnetron Operating from 700 cps to 225 mc

Frequency	Anode Voltage	D-C Input (Watts)	R-F Ouput (Watts)	Eff (%)	Mode Type
700 cps	134	3.35	0.252	7.5	Class-A
	(Tank Q too low to start Class-C oscillation)				
2.1 mc	76	0.80	0.053	6.6	Class-C
	123	0.81	0.020	2.5	Class-A
38.5 mc	140	2.24	0.125	5.6	Class-A
	(Tank Q too low to start Class-C oscillation)				
116 mc	59	0.54	0.080	14.8	T-W
	70	1.79	0.210	11.7	Class-C
	140	2.8	0.125	4.5	Class-A
225 mc	67	1.34	0.185	13.8	T-W or Class-C
	140	2.31	0.080	3.5	Class-A

peak of the surge, where the negative conductance is much higher than it is at the origin, to sustain oscillation. Thus maximum current is collected at the most negative anode over a short portion of the r-f cycle, and the circuit is kept oscillating as in a class-C oscillator.

Class-C negative-conductance oscillations begin and drop out abruptly and are about 10 percent efficient. The starting and loading-out behavior are very similar to traveling-wave oscillations and much above 100 mc it is sometimes difficult to distinguish between the two types, since the ranges of operating voltage for each type overlap considerably.

Several tubes were checked at five spot frequencies from 225 megacycles down to 700 cycles per second. Selected data from these tests are listed in Table I. At each frequency the loading was adjusted to give optimum power output. The data particularly show the transitions between the three possible types of oscillation and the relative efficiency of each for increasing values of anode voltage.

Note that the efficiency drops with increasing voltage at each frequency point. The output powers given are not the maximum attainable in any given mode. They lie near the middle of the voltage range for each mode. In operation, the moding action is recognized by an abrupt change in operating current as the voltage is changed uniformly in one direction.

From the data it is seen that much above 100 mc it is evidently most practical to utilize the traveling-wave mode for local-oscillator use. However, even though the class-A mode is least efficient, it does permit 100-percent amplitude modulation of the magnetron with minimum distortion and frequency modulation, a characteristic that may find other practical applications.

Tuned-Circuit Design

The use of printed circuits in vhf and uhf applications of the Z-2061 is entirely feasible and such commercial tuning elements as the vhf Mallory Inductuner work very well.

Two factors inherent in the tube design dictate the design of the external tuning circuits. These include the anode-to-anode capacitance and anode lead inductances. If the tube is mounted in a typical molded socket and the anode pins are shorted as close to the socket as possible the oscillating frequency will be near 600 mc. This upper frequency may be raised to 1,000 mc by first series-resonating the lead inductances with a small capacitor placed in series with each anode lead. This effectively places the anodes electrically much nearer the anode pins. A shorted transmission line may now be connected to these capacitors and used to tune the entire uhf band. The length of this line will be less than one quarter wavelength by the amount of foreshortening due to the inter-anode capacitance. The line may also be operated in a three-quarter wavelength mode above 900 mc.

Alternate Method

An alternative tuning method has been used which results in somewhat stronger oscillations above 600 mc. In this method an open-ended transmission line is connected either directly or through the series capacitors to the anode pins. The operation results in a half-wave distribution on the line with a voltage minimum near the pins and voltage maxima inside the tube at the anodes and at the open end of the line.

To tune the entire 400 to 1,000-megacycle range, a novel type of tuned circuit has been developed using a combination of the tuning and compensating methods just described. Essentially it consists of an open-ended transmission line

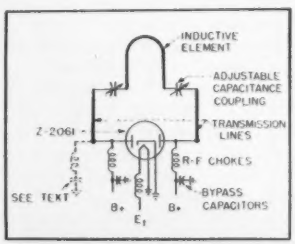


FIG. 7—Equivalent electrical circuit

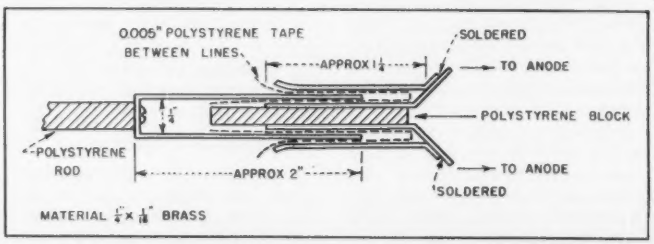


FIG. 8—Tuning element for continuous coverage of frequency range from 515 to 930 mc

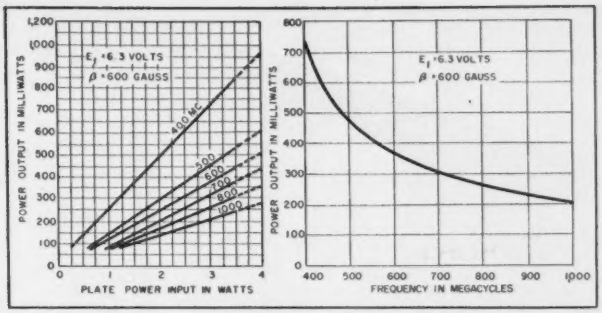


FIG. 9—Curves show power output as function of input (left) and frequency (right)

capacitively coupled to a short-circuited line. With large coupling the two elements combine to act like a short-circuited quarter-wave line. As this capacitance coupling is decreased there is a gradual transition from the quarter-wave line mode to a half-wave line mode. Figure 6 is a drawing of a tuner strip which covers the frequency range from 500 to 600 mc. The frequency increases as the spacing between the open and short-circuited lines is increased.

The photograph shows a turret tuner which uses six tuner strips similar to that shown in Fig. 6. This tuner can be adjusted to resonate at six different frequencies between 400 and 1,000 mc. The tuning ranges of each strip are made to overlap to assure operation at all possible frequencies in the band.

Figure 7 shows the equivalent electrical circuit of the tuner connected to a magnetron. Plate voltage is applied through a pair of r-f chokes consisting of 15 turns of No. 28 wire on a $\frac{1}{4} \times \frac{1}{8}$ in. phenolic coil form. To prevent spurious oscillation at the choke resonant frequency, the chokes may be wound over 200-ohm, one-half watt resistors and connected to their terminal leads.

Another type of tuner using the same tuning method was designed to provide continuous tuning from 515 to 930 megacycles. Figure 8 shows the constructional details of the tuning element.

It has been found that the addition of a small r-f choke and series blocking capacitor connected from one anode to chassis ground, as shown dotted in Fig. 7, greatly improves operation at frequencies over 700 megacycles. In the tuners shown in the photographs, an inductance of approximately 0.25 microhenry and a blocking capacitor of 10 $\mu\mu$f were found to be satisfactory. Design consideration should be given to disconnecting this L-C combination below 500 megacycles since it may affect operation of the tube at the lower frequencies.

Operating Conditions

Power output measurements in the range between 400 and 1,000 mc are shown at left in Fig. 9. With a maximum plate input of 3 watts, the tentative maximum rating of the tube, an average power output of 725 milliwatts has been measured at 400 megacycles and 210 milliwatts at 1,000 megacycles. These curves also show that power output is proportional to power input. The relationship between power output and frequency at 3 watts input is also shown in Fig. 9.

Frequency stability measurements of the turret tuner have been made as a function of line voltage, filament voltage, plate supply voltage, flux density, and time. The results of these measurements show that changes in plate voltage and filament voltage compensate each other. This, of course, is an advantage when the line voltage is changed. The dependence of stability on the magnetic field is not a problem because the magnetic field is quite constant over a long period of time.

The average frequency drift during the first 20 minutes is about 400 kc. In designing a tuner, consideration should be given toward compensating for frequency drift due to temperature change.

With the oscillator circuit tuning fixed near 900 megacycles, the average spread in frequency among 25 sample tubes was approximately 20 megacycles.

Measurements of sixty-cycle hum indicate that the hum and noise level is down more than 60 db below the carrier level. With d-c operated heaters, the noise-to-carrier ratio is better than −75 db. The radio-frequency spectrum, as observed on a spectrum analyzer, shows only a single-frequency signal when observed over a bandwidth up to 60 megacycles.

Several tests made to determine the effect of variations of cathode-anode alignment with respect to the tube pins indicate that once the magnet has been aligned for minimum plate current, further adjustment of its position in replacing tubes is unnecessary. However, the initial alignment of the magnet to within a few degrees may be necessary. Design activity on the magnet structure is under way and future designs may possibly eliminate the alignment procedure.

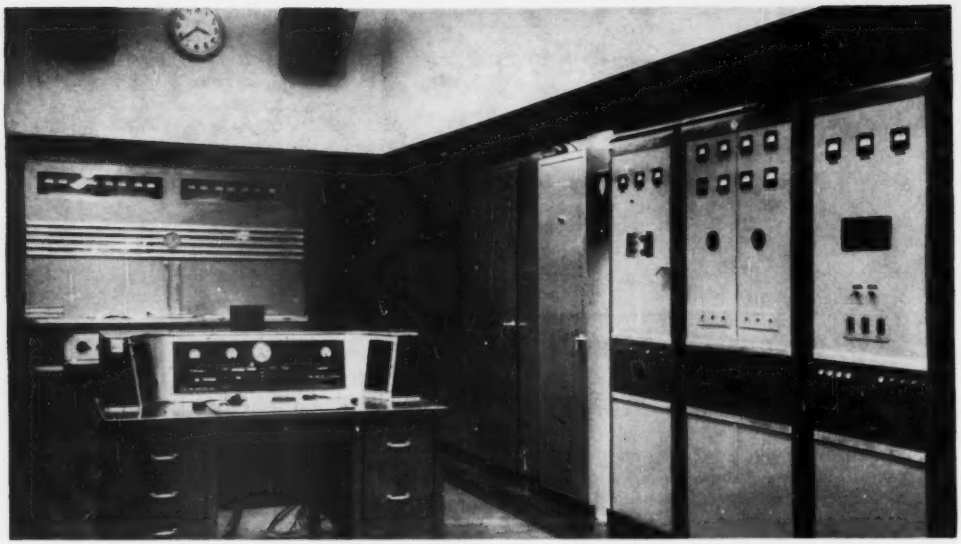
Conclusion

Although the miniature magnetron has been designed primarly for use as a local oscillator its application is not necessarily limited to this service. The extreme frequency range, 0 to 1,000 mc, and relatively large output make it an intriguing tool in such apparatus as signal generators, transmitters operating in the citizen's band, and wherever a low power, compact, and stable source of r-f energy is required.

Availability

The Z-2061 is not currently commercially available. Shortages of cobalt and nickel which are essential in the manufacturing of Alnico V have necessarily curtailed any production plans for the tube.

The authors wish to acknowledge the valuable assistance of C. R. Knight and L. U. Hamvas of the Advanced Development Section of the Tube Divisions in the design and development of this tube.



Complete emergency television transmitter with filaments lighted. In event of main transmitter failure, operator flicks toggle switch and moves chair to emergency console. Coaxial cable run starts behind false wall back of clock and continues around to right. Tall cabinet to left of oscilloscope houses 2,000-mc link that programs Bridgeport uhf experimental transmitter

Reducing Outage

By LESTER A. LOONEY and FREDERICK C. EVERETT

Assistant Manager — *Radio and Allocations Engineering*, *National Broadcasting Co., Inc.*, *New York, N. Y.* — *Engineer*

WITH the installation of a new television and frequency-modulation antenna for the National Broadcasting Company, atop the Empire State Building,[1] some innovations were made in the feed arrangements between the tv and f-m transmitters and the antenna.

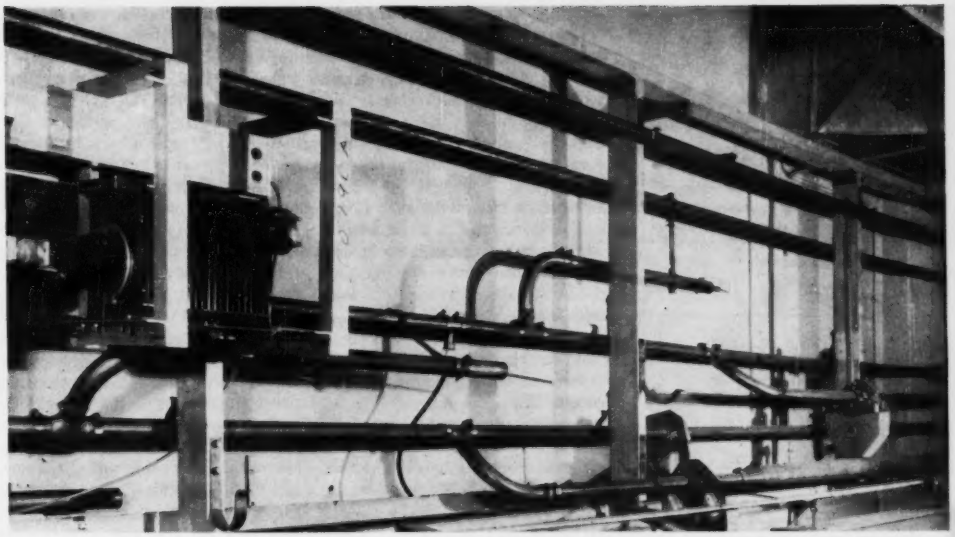
The time charges at WNBT have now reached $4,000 an hour. Added to this figure must be such items as talent costs. It can be seen that with even a short-time outage, serious financial losses can result. At the present state of the art, it is virtually impossible to eliminate transmitter outages completely, tube failures being one important factor.

To provide tv operation with a minimum of outages, a second tv transmitter, picture and sound, has been used for emergencies. This transmitter, in the past, was normally connected to an emergency antenna, which allowed its immediate use when needed, by merely applying plate voltage. Facilities were provided whereby the coaxial lines could be opened up and elbows moved to plug the emergency transmitters into the regular antenna, but this was cumbersome and could result in delay and lost air time.

Because the emergency antenna had lower gain than the regular antenna, in case of transmitter failure the operator was faced with a difficult choice whether to switch transmitters, make repairs, or sacrifice coverage by operating on the emergency antenna. Should he elect to rectify the trouble he might later regret his selection because it might have been quicker to spend a few minutes in changing transmitters.

The new arrangement here described, makes it possible to switch emergency sound or video transmitters to the regular antenna and to do so practically instantaneously.

Referring to Fig. 1, the outputs of two transmitters are joined together and to the antenna feed by means of a tee. Back a quarter wave toward each transmitter is placed a transmission line switch



Top two lines carry f-m. Next line down is emergency sound. It passes through coax switch. To it is attached compensating stub near center of picture. Regular sound line comes in from right through another coax switch and joins extension of emergency sound line. Next lines visible are emergency picture and regular picture lines

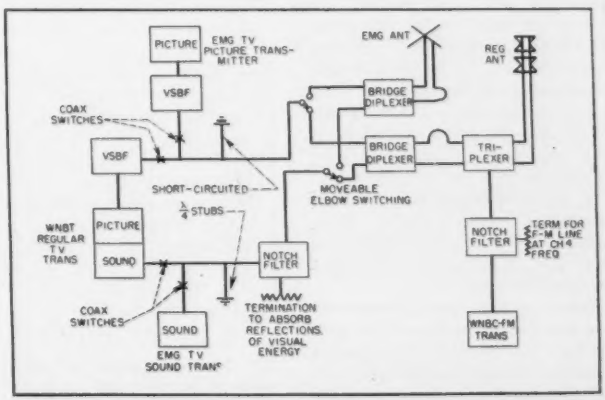
at WNBT and WNBC-FM

With television time charges at $4,000 an hour, transmitter outages can no longer be tolerated. Standard coaxial lines and iris-type shorting switches uniquely arranged allow a quick changeover to the emergency transmitter without interaction with f-m equipment triplexed to same antenna

of the short-circuiting iris type. A short circuit on the unused transmitter line is reflected as an open circuit at the tee connection and allows the signal from the transmitter in use to proceed along the line toward the antenna.

These switches were originally designed for power cut-back systems in f-m transmitters and were not considered sufficiently broad banded for tv use. Furthermore, the presence of the tee fitting and the quarter-wave stub left on the other leg of the tee produces a certain additional amount of discontinuity on the transmission line.

By placing an adjustable, short-circuited, quarter-wave stub a



Complete transmitter and antenna system used at WNBT and WNBC-FM

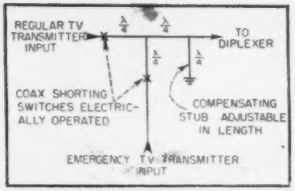

REGULAR TV TRANSMITTER INPUT
TO DIPLEXER
COAX SHORTING SWITCHES ELECTRICALLY OPERATED
COMPENSATING STUB ADJUSTABLE IN LENGTH
EMERGENCY TV TRANSMITTER INPUT

FIG. 1—Elementary arrangement of coaxial shorting switches and compensating stub for emergency transmitter changeover

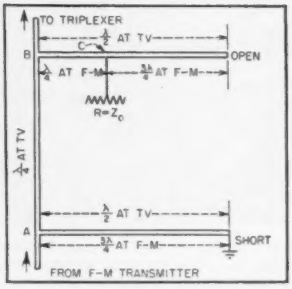


FIG. 2—First approximation of a filter interposed between the WNBC-FM transmitter and common-antenna triplexer

quarter wavelength farther along the line toward the antenna, it was possible to broad-band the switching system. It is a well-known principle that two identical discontinuities a quarter wave apart will cause nearly complete compensation for each other over a relatively wide frequency range.

Before installation the effect of the switching without the compensating stub was checked and while the discontinuity was small, it was easily detectable. With the compensation, the effect is hardly measurable and the stub can be adjusted in advance by the utilization of sweep methods. It was probably not necessary to supply a compensating stub on the sound line, the standing-wave-ratio requirements not being so severe. However, it was simple to build two, so both picture and sound lines were treated similarly.

These transmission line switches are solenoid-operated and are controlled by special five-position switches mounted in the operator's console. To change from one transmitter to the other requires only a flip of the switch. They are suitably interlocked so that the transmitter in use is turned off, the coaxial switch solenoids are pulsed and the other transmitter is turned on in sequence so that the r-f power cannot be applied unless and until the switches are in the proper position.

In practice the switchover is accomplished essentially in the length of time it takes the regular transmitter plate contactors to operate, and the transition is barely recognizable on the air.

Antenna switching between regular and emergency antennas is done by means of double elbows in such a manner that a coaxial patch panel is used. Presumably antenna failures will be few and far between and a few moments longer may be taken to perform this operation.

Triplexer

The tv and f-m signals are all radiated from the same antenna. As the complete tv signal radiated consists of the output of two transmitters, these signals are combined in a diplexer. Similarly, for the f-m signal, a triplexer unit is used. This is a notching type of filter that is now a standard commercial product, originally developed several years ago for the NBC Washington station, WNBW.[3] Similar notch filters are used in such applications as part of the tv vestigial sideband filter.

Due to the physical layout of the station, it would have been almost impossible to install the triplexer close to the f-m transmitter. To do so would have made the tv transmission-line route complex and undesirable. However, since the notching filter in the triplexer consists of tuned circuits (in this case, made of coaxial transmission-line elements) it is vulnerable to impedance presented to its f-m input.

When the triplexer had been installed in a convenient place, the distance back to the f-m transmitter was in the order of 90 feet. The f-m transmitter output circuit presents some variable impedance—which may be variable in value due to tuning. But even if the impedance has a fixed value, as it goes through the length of transmission line connected to it, the values presented along the line go through a complete cycle every half wavelength. This means that at the end of this line containing a large number of half wavelengths, the impedance varies rapidly with frequency. Resonance effects therefore occur with the triplexer circuit elements to cause undesired tv feedthrough into the f-m transmitter with a corresponding mismatch point within the tv frequency band.

Separation Filter

To remove the effect of line length it was desirable to equip the line with a separation filter so designed that the f-m passed through it unimpeded but so made that looking into the f-m line from the triplexer in the direction of the f-m transmitter, the line is terminated in a pure resistance across the tv channel.

A sketch is shown in Fig. 2 of

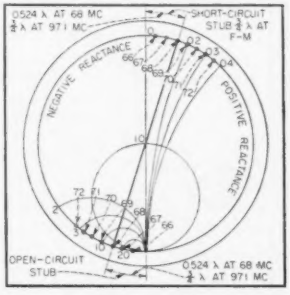

0.524 λ AT 68 MC
¼ λ AT 971 MC
SHORT-CIRCUIT STUB ¾ λ AT F-M
NEGATIVE REACTANCE
POSITIVE REACTANCE
OPEN-CIRCUIT STUB
0.524 λ AT 68 MC
¼ λ AT 971 MC

FIG. 3—General method of plotting values of ¾ wavelength f-m lines to find characteristic at television frequencies

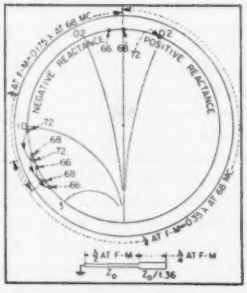


FIG. 4—Fundamental Smith-chart plot shows how short-circuited stub can be modified to have zero impedance at tv midband

the filter, built of coaxial transmission-line elements. The sketch shows the inner conductors only, for simplicity, and indicates that it is installed on the transmission line normally coming out of the f-m transmitter (proceeding in the direction from *A* to *B*).

At point *A* there is a tee that connects a short-circuited stub ¾ wavelength long at the f-m frequency. To point *A*, therefore, the stub presents a high or infinite impedance and the f-m signal goes by undisturbed. At point *C* there is an open-circuited stub ¾ wavelength at the f-m frequency. This produces a short circuit at the f-m frequency at point *C*. The addition of a resistor at this short circuited point has no effect on the f-m because of this short-circuited condition. Point *C* is joined to the tee at point *B* by an additional quarter wavelength of line that causes a high or infinite impedance to be presented to the f-m at point *B* so the f-m signal goes by undisturbed enroute to the triplexer.

Filter at TV Frequencies

By a fortuitous circumstance, ¾ wavelength at the f-m frequency (97.1 mc) is almost exactly a half wavelength at channel 4 (66 to 72 mc). This is not quite true, but for the purposes of discussion it is assumed so. It will be shown later how the discrepancy is handled.

Since the short-circuited line at point *A* is a half wavelength at the picture frequencies now under consideration, it presents a short circuit at this place. The effect of the f-m transmitter is negligible since it is connected to a short-circuited point. The length of line between *A* and *B* is made a quarter wavelength at the picture frequencies so that the short circuit at *A* becomes an open circuit at *B*, in effect disconnecting the f-m transmitter and stubs at that point. Similarly, at *C*, the paralleled stub that is a half wavelength long at tv and open-circuited, produces only an open circuit there, where the resistor is attached.

Looking into the line from the triplexer in the direction of the filter and f-m transmitter, the line sees the resistor at *C* only at television frequencies. Since this is a termination on the line, the length of the line is no longer significant.

Use of Smith Chart

Figure 3 shows the method of making a Smith chart plot[3] of the open-end short-circuited stubs that are ¾ wavelength at f-m frequencies. It can be shown that zero impedance at the start of the stub does not result in a short circuit at the various frequencies in the television band since rotating through ¾ wavelength at the f-m frequency is somewhat more than a half wavelength at tv. Similarly, the open-circuit stubs produce various values of impedance which are high, but none of which are infinite in the television band.

However, changing the characteristic impedance of the lines, at the points that are a quarter wavelength or multiples of a quarter wavelength at the f-m frequency can result in correction, if properly done, such that the midband television impedance can be made infinite and zero for the two stubs. This will cause no change in the action of the stubs at f-m frequency.

Figure 4 indicates the method of plotting the short-circuited stub. The first quarter wavelength of the stub is made of a piece of line of lower impedance than the last half wavelength, by changing the diameter of the inner conductor. The impedance of the end of the stub is thus made zero at midband of the television channel.

Similarly, Fig. 5 shows the effect of changing the characteristic impedance of part of the open-circuited stub, causing the television midband impedance to be infinity.

The completely developed filter is shown in Fig. 6, while Fig. 7 gives the physical layout with some folding done to make the unit occupy a reasonable amount of space.

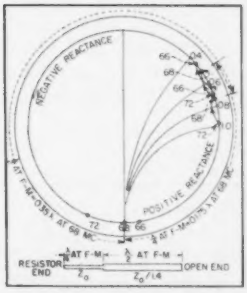


FIG. 5—Open-circuited stub can be formed from two different diameters of inner conductor to represent infinite impedance

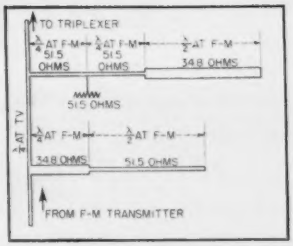


FIG. 6—Completely developed filter differs from that of Fig. 2 by its effectiveness at television frequencies

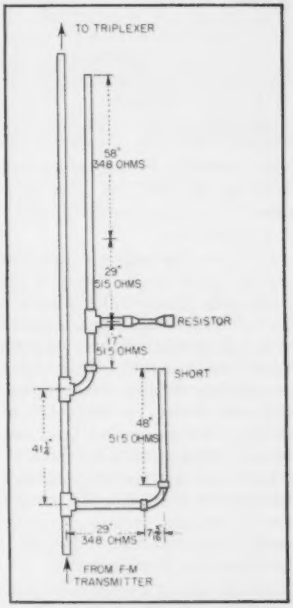


FIG. 7—Physical dimensions of the filter show how it can be constructed from standard fittings

References

(1) Frank G. Kear and O. B. Hanson, Television Totem Pole, ELECTRONICS, p 66, Feb. 1951.

(2) L. J. Wolf, Triplex Antenna for Television and F-M, ELECTRONICS, p 93, July 47.

(3) Phillip H. Smith, Improved Transmission Line Calculator, ELECTRONICS, p 130, Jan. 1944.

Nuclear-Resonance

Nuclear-resonance technique makes it possible to regulate a 35-ton magnet with four type 807 tubes to accuracies approaching 0.0025 percent. Servo system control loop is actuated by negative-resistance resonance detector coupled to a proton sample vial of water or mineral oil. Measurements of absolute field obtained with oscilloscope and frequency meter

RAPID GROWTH of scientific research and development has led to numerous applications requiring the precise measurement or stabilization of magnetic fields. Among the better-known applications that are receiving increased attention in both industrial and basic research are mass spectrometry (gas analysis and mass measurement), magnetron development and cyclotrons.

Previous conventional methods, such as using a search-coil or bismuth spiral for obtaining a correcting or measuring signal directly from a magnetic field are relatively insensitive to small field changes. In addition, absolute measurements with such devices are limited to accuracies of the order of 1 percent. Because of the relative insensitivity of these methods, magnet regulators have usually been designed to regulate the magnet excitation current resulting in stabilization factors of the order of a few thousand.

By the use of nuclear resonance techniques described here it is possible, with relatively simple apparatus, to obtain stabilization factors ranging from 10^5 to 10^8 and to make absolute field measurements with accuracies approaching 0.0025 percent. The techniques involved are largely of a radio-frequency nature and the magnetic field is determined by measuring a frequency.

Protons characterized by a spin I and magnetic moment μ are established in two energy levels when immersed in a magnetic field H_o. These two states differ in energy by an amount

$$\Delta w = \mu H_o / I = h\nu \qquad (1)$$

The division of nuclei between the two states is governed by the Boltzmann factor which gives a slight surplus in the lower state if the proton sample is in thermal equilibrium at ordinary temperatures. Application of a weak radio-frequency field produces transitions between the levels with a net absorption of energy from the r-f field as long as there remains a surplus of protons in the lower state. To fulfill this latter condition, the net energy gained by the protons must be lost to the surrounding lattice.

This process takes place with a characteristic relaxation time T_1. Thus, it can be seen that the absorption of energy from the r-f field tends to upset the normal equilibrium population of the states by equalizing it and the new equilibrium established is a balance between the process of energy absorption by the spin system and transfer of this excess energy to its surroundings.

From Eq. 1 it is seen that the absorption of energy takes place at a single frequency. Actually, if all the active nuclei in the sample see the same field, H_o, the sample shows a small but finite resonance width. In practice, field inhomogeneities spoil this condition and broaden the resonance. The observed line width may be expressed in terms of the frequency width or the magnetic field width at half maximum. A second relaxation time T_2^* is a measure of the inverse line width and is given by $T_2^* = 1/\pi\Delta\nu$ where $\Delta\nu$ is the full line width at half maximum.

Equation 1 can be put in the form

$$\omega_o = \gamma H_o \qquad (2)$$

where $\omega_o = 2\pi\nu$, $\gamma = 2\pi\mu/h$ I and is known as the gyromagnetic ratio of the nucleus. The value of the gyromagnetic ratio of the proton in absolute units has been recently measured[1] with an uncertainty of less than 25 parts per million. This makes it possible to measure magnetic fields with accuracies approaching 25 ppm by means of a relatively simple radio-frequency apparatus for detecting proton

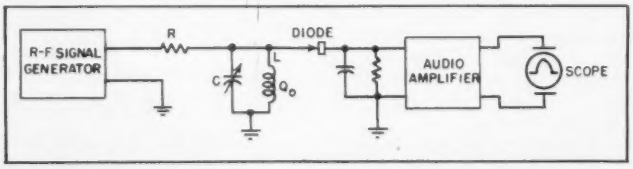


FIG. 1—Basic detector circuit can be modified for control of large magnet

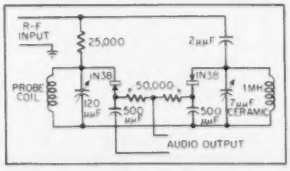
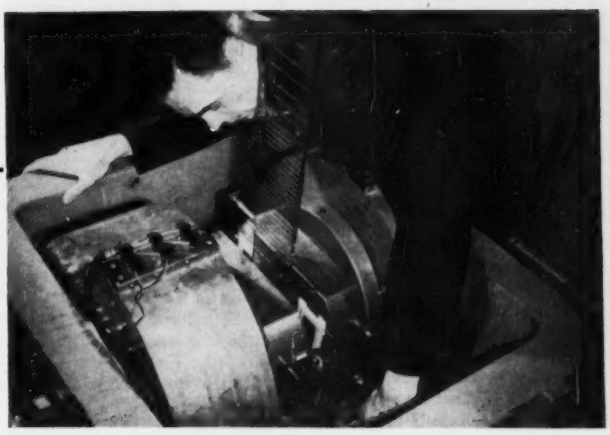


FIG. 2—Amplitude bridge circuit

Magnetic Field Control

By H. A. THOMAS
National Bureau of Standards
Washington, D. C.



The nuclear resonance probe being used to measure the field distribution of a magnet. The probe, at lower center, is mounted on a crossfeed for accurate positioning in the magnet gap

transitions in a water or oil sample and frequency measuring apparatus that is readily available.

Transition Detector

In the absorption method, the essential apparatus for detecting transitions takes the form of a small r-f coil, approximately 1 cm in diameter for fields of the order of 1,000 to 20,000 gausses, with its axis at right angles to the field H_o. A glass vial containing water or mineral oil may be placed in the r-f coil for the proton sample. The coil is resonated with a capacitor and fed through a high impedance from a signal generator as shown in Fig. 1.

If the field or frequency is adjusted to that value at which the transition takes place, that is, the resonant frequency, power will be absorbed from the coil, the Q will drop, and the r-f voltage across the coil will decrease. It is customary to modulate the field or frequency at an audio rate so that the r-f voltage across the coil will be modulated as the nuclear-resonant condition is passed through. It simply remains, then, to arrange suitable r-f amplifiers, detectors, and audio amplifiers to display the nuclear absorption line on an oscilloscope.

Bloembergen, Purcell, and Pound[3] have shown that the power absorbed per cu cm of sample is given by

$$P\alpha' = \frac{\gamma^2 H_1^2 N_o (h\nu)^2 (I+1) I\, g(\nu)}{6KT} \quad \text{ergs/sec} \qquad (3)$$

and that where the line width is not the natural line width, T_2, but is broadened by inhomogeneity in the magnetic field, the line shape function, $g(\nu)$, can be conveniently expressed in terms of a relaxation time T_2^* by the relation $T_2^* = g(\nu)/2$. In Eq. 3, K is Boltzmann's constant, T the absolute temperature, N_o the number of active nuclei per cu cm of sample, and H_1 half the magnitude of the r-f magnetic field. The oscillating magnetic field of magnitude $2H_1$ can be considered to be made up of two fields each having a magnitude H_1 and rotating in opposite directions. They have further shown that because of saturation the signal predicted by Eq. 3 is reduced by a factor of two when the optimum r-f field, $2H_1$, is used. This optimum r-f field is given by

$$H_1^2 \gamma^2 T_1 T_2^* = 1 \qquad (4)$$

Substituting these relations into Eq. 3 and introducing the volume of the sample $v_o\alpha$, where v_o is the volume of the coil and α is a filling factor for the sample, the total absorption is obtained

$$P\alpha = \frac{v_o \alpha\, N_o (h\nu)^2 I (I+1)}{6KT\, T_1} \text{ ergs/sec} \qquad (5)$$

Power Needed

The power input to the coil required to maintain the optimum value of r-f magnetic field can be easily obtained as follows, if it is remembered that for a simple solenoid approximately all of the energy stored in the magnetic field is contained in the volume of the coil and that H_1 is half the amplitude of the r-f magnetic field. Since energy density is $H^2/8\pi$ the total energy E_o stored in the magnetic field is

$$E_o = H_1^2 v_c / 2\pi \qquad (6)$$

Recalling that $P_o = \omega E_o/Q_o$ and using Eq. 4 and 5 there is obtained the power required to maintain the field H_1

$$P_o = \frac{\omega v_c}{2\pi \gamma^2 T_1 T_2^* Q_o} \qquad (7)$$

where Q_o is the Q of the r-f coil in the absence of an absorption signal.

Now assume that the L-C circuit receives its power, P_o, from a generator having a resistance many times greater than the equivalent shunt resistance, R_o, of the tuned L-C circuit thus making essentially a constant-current circuit in which the loading effect of the generator need not be considered.

Let the voltage across the L-C

circuit in the absence of nuclear absorption be V_s and the change in this voltage due to the peak absorption be ΔV then since $i = (P_s/R_s)^{1/2}$ and $P_\alpha = i\Delta V$ we get as a good approximation

$$\Delta V = P_\alpha (R_s/P_s)^{1/2} \quad (8)$$

Dividing Eq. 5 and 7 by 10^7 to put them into practical units and then substituting them into Eq. 8 we get

$$\Delta V = \frac{I(I+1)\,h^2\,\gamma\,N_s\,v_c\alpha}{6KT\,(10^7)^{1/2}\,v_0^{1/2}} \left(\frac{T_2^*}{T_1}\,R_s Q_s \nu^2\right)^{1/2} \text{volts} \quad (9)$$

The quantity T_2^* is a measure of the inverse line width and is dependent only on the area and maximum value of the line shape curve. If $g(\nu)$, the line-shape function, is that of a simple singly-tuned circuit it may be shown[3] that $\Delta\nu$ the width of the line between half maximum points (on a power basis) is $1/\pi T_2^*$. From this relationship, Eq. 7, and the relation that $\omega_s = \gamma H_s$ it may be shown that the power required to maintain the optimum r-f field is

$$P_s = \frac{H_s H_2 v_c}{4\pi T_1 Q_s} \quad (10)$$

where H_2 is the line width at half maximum in oersteds. The coil voltage required to maintain this field is

$$V_s = (P_s R_s)^{1/2} = \left(\frac{H_s H_2 v_c R_s}{4\pi T_1 Q_s 10^7}\right)^{1/2} \text{volts} \quad (11)$$

For a water sample at room temperature, Eq. 7 reduces to

$$\Delta V = 7.5 \times 10^{-17} \left(\frac{T_2^*\, v_0\, R_s\, Q_s\, \nu^2}{T_1}\right)^{1/2} \alpha \text{ volts} \quad (12)$$

It will be recalled from an earlier discussion that T_2^* is related to the absorption line width and may be expressed either in terms of frequency $\Delta\nu$ or in terms of gausses H_2 by the relations $T_2^* = 1/\pi\Delta\nu = 2/\gamma H_2$.

For pure water, the natural line width is of the order of a few milligausses but the measured line widths are usually much greater than this because of inhomogeneities in the field H_s. Where this is the case, paramagnetic ions may be added to the water sample without appreciably altering the observed line width. Adding ferric nitrate has the advantage that the interaction between the protons and the lattice (surrounding sample) is increased, decreasing the rate of energy transfer and thus decreasing the value of T_1. For pure water T_1 is of the order of 3 sec but by the addition of a small amount of ferric nitrate may be decreased to an order of 10^{-2} to 10^{-4} thus increasing the available signal by a factor of at least 1,000.

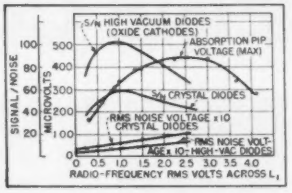

S/N HIGH VACUUM DIODES (OXIDE CATHODES)
ABSORPTION PIP VOLTAGE (MAX)
S/N CRYSTAL DIODES
RMS NOISE VOLTAGE x 10 CRYSTAL DIODES
RMS NOISE VOLTAGE x 10 HIGH-VAC DIODES
SIGNAL/NOISE
MICROVOLTS
RADIO-FREQUENCY RMS VOLTS ACROSS L1

FIG. 3—Signal and noise characteristics of amplitude bridge

In most cases, depending on the field inhomogeneity, it is possible to make T_1 about equal to T_2^*. In practice the optimum condition is obtained by adding the ferric nitrate very slowly while watching the absorption signal grow in magnitude until it is seen that the absorption line starts broadening instead of increasing in magnitude.

Representative Measurement

To illustrate the use of the above equations, the following example of some measurements made with the detector circuit shown in Fig. 2 is given. This circuit is one of the very few that lends itself readily to the absolute measurement of absorption pip magnitudes. With a Q_s of 100, $R_s = 4{,}000$ ohms, $v = 1.5$ cu cm, $v_0\alpha = 0.4$ cu cm, $\nu = 20$ mc, and $H_s = 4{,}700$ gausses, the line width of an adjusted water sample was 0.5 gauss and the maximum signal occurred at an r-f coil voltage of 2.4 volts. Using Eq. 11 gives a value for T_1 of about 2×10^{-4} sec and substituting this in Eq. 12 indicates that ΔV should be about 1,100 microvolts.

Since the bridge circuit of Fig. 2 reduces the audio output voltage by a factor of 2 and the rectification efficiency of the diodes, ϵ, is approximately unity, the output signal should be about 550 μv. This can be compared with the actual observed output voltage of 490 μv. This is closer agreement than would normally be expected. The absorption pip voltage curve of Fig. 3 illustrates the saturation effect mentioned earlier, which gives rise to the optimum r-f coil voltage.

Detection Circuits

Several different types of circuits have been developed for the detection of nuclear resonance signals, only a few of which will be discussed here. The simplest type of circuit is, perhaps, the amplitude bridge[5] circuit shown in Fig. 2 that stems directly from the basic detector of Fig. 1. In that, the coil L containing the water sample is tuned to resonance at the required frequency by C. The resulting resonant circuit having a shunt resonant impedance R_s, is fed from a signal generator through an impedance $R >> R_s$. The change in r-f voltage across the L-C circuit that results when the d-c magnetic field H_s is varied through the value required for nuclear resonance is detected by the diode circuit.

The value of H_s may be varied repetitiously through the critical value by applying a low audio-frequency sweep voltage to small Helmholtz coils mounted on either side of the sample. The resulting audio voltage output of the diode circuit may be amplified and displayed on an oscilloscope.

This circuit is not practical because the noise modulation usually present in the output of the average signal generator will mask the desired signal. In the amplitude bridge of Fig. 2 this noise modulation is cancelled out by having another voltage dividing network and diode detector that detects only the generator noise and then combining the two outputs in phase opposition so that the noise modulation cancels out in the output, whereas the signal does not.

This system does not eliminate noise generated in the diode circuits and, since this is usually much greater than the thermal noise generated in R_s, the circuit has a rather poor noise figure. In spite of this, the circuit will produce quite adequate signal-to-noise ratios as indicated in Fig. 3 and the resonance-line photograph for fields above a

few thousand gausses. It displays only the absorption component and is relatively insensitive to microphonics but is not readily tunable. For the latter reason, the circuit is quite satisfactory for use in field-regulator application but not for field measurement.

The photograph shows an amplitude-bridge resonance probe mounted on a crossfeed in a magnet gap for plotting the field distribution. Another probe operating from the same signal generator was used to stabilize the field, while field variations were plotted by noting the bias current through the Helmholtz coils on the movable probe. An inner set of Helmholtz coils is used as magnetic sweep. Relative field measurements of this type can easily be made to 1 part in 10^5.

R-F Bridge Detector

Since the detection of nuclear resonance signals requires detecting a very small change in a relatively large r-f voltage, it would appear that an r-f bridge could be utilized to advantage because the steady component could be reduced to the point where low-noise r-f amplifiers could be used to advantage and also noise modulation of the signal generator could effectively be reduced in the output.

Circuits of this type using a straight r-f bridge[3] and a bridge-T network[4] have been used that show excellent noise figures. These circuits are not particularly applicable to field measurement or regulation, however, because of their complexity, microphony, and critical adjustment required. In addition they are not readily tunable and since they are phase-sensitive as well as amplitude-sensitive they also may indicate the dispersion component of the resonance signal.

It might be noted that resonance absorption, except for the saturation effect, produces a signal much as if a high-Q tuned circuit were coupled into the coil L, thus indicating a reactance term (corresponding to the dispersion component) as well as the resistance term.

As early as 1947, Roberts[5] pointed out that either a superregenerative oscillator or a simple regenerative oscillator could be used as a detector of nuclear-resonance signals and these methods have been used[6,7] to some extent. It appears that the simplest and best circuit for field measurement is a negative-resistance oscillating detector developed by R. D. Huntoon and A. Weiss of the National Bureau of Standards. This is a free-running tunable oscillating detector but a slight modification of the original circuit, replacing a feedback capacitor with a crystal, X, as shown at the bottom of Fig. 4, will stabilize the oscillation frequency at the series-resonant frequency of the crystal and make the same circuit highly suitable for the field stabilization application.

When oscillating at a low level, the magnitude of oscillation of this circuit is extremely sensitive to small changes in impedance of the L-C circuit. While the theory of this circuit as a detector has not been completely worked out nor has the noise figure been measured, comparison of the signal-to-noise ratios obtained between this and other methods of detecting nuclear resonance indicate that it is very good. The required low level of oscillation is obtained by using a reduced plate voltage of only 45 volts and then reducing further by means of the 50,000-ohm variable resistor. In addition, reduced filament voltage can be used if desired.

The audio output signal can be obtained in three different ways. Since a change in r-f level will change the grid bias that will be amplified and will appear in the plate circuit as a superimposed audio voltage, the signal can be taken directly from the plate of one of the tubes through an r-f decoupling network as indicated. The grid bias change can be taken directly off the grid circuit at S. In either of these methods audio noise generated in tube T_1 appears in the output and hence to obtain the best signal-to-noise ratio the diode circuit shown in the lower left-hand corner should be used. The diode circuit is connected across points A and B and the grid-leak capacitor C_1 is changed to 10 μf so that the grid bias cannot change. Audio tube noise is prevented from reaching the diode circuit by the 100-μμf capacitors. This method gives a much better signal-to-noise ratio than either of the other two methods but for most purposes they are good enough.

Field Measurement

From Eq. 2 it can be seen that to measure a magnetic field strength H_o it is only necessary to measure the frequency required for proton resonance in that field. The value[1]

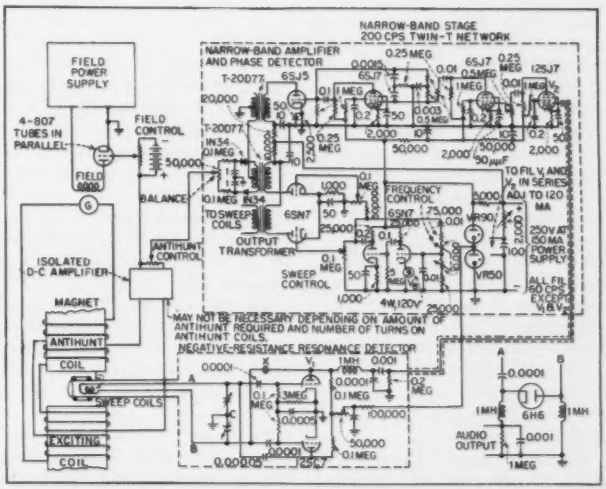


FIG. 4—Circuit of the magnetic regulator applied to control of 35-ton magnet

of γ is $\gamma = (2.67528 \pm 0.00006) \times 10^{-4}$ sec^{-1} gausses^{-1} and since frequency can be easily measured to a few parts per million, the limit of accuracy on field measurements is limited by the uncertainty in γ or the signal-to-noise ratio of the detecting circuit. The signal-to-noise ratio depends on the detector noise figure, the size of the water sample, and the inhomogeneity in the field. The greater the field gradient, the smaller the sample has to be to keep the total line width within a reasonable value.

With the negative-resistance oscillating detector, usable signal-to-noise ratios have been obtained in fields of 4,000 gausses having a gradient of approximately 5 gausses per cm. The sample used in this case was about 2 mm in diameter. With smaller gradients, it can be used in fields as low as a few hundred gausses.

In practice, the circuit shown at the bottom of Fig. 4 is built in the form of a probe with the coil L mounted in the end of a brass tube a foot or so long and the rest of the circuit mounted in a small box on the other end. If it is desired to make the complete unit portable, the filament battery (d-c is required to prevent 60-cps modulation), 45-volt plate battery and any additional audio stages can be mounted in a portable carrying case.

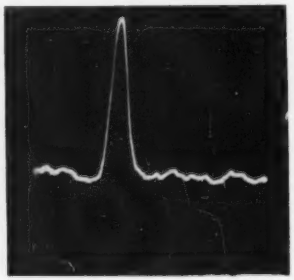
The sweep coils can be excited from 60-cps filament supply if desired. If the sweep voltage is applied to the horizontal input of the scope and the signal output to vertical input, a double trace of the resonance pip will be seen. With a slight phase shift, the pips will be separated slightly and the crossover point makes an excellent indication of the center of resonance. Using a broad sweep, resonance can be approximately located by tuning C and then for the final adjustment decreasing the sweep voltage to approximately a line width.

If desired a lock-in amplifier or phase detector similar to that used in the field regulator may be used and the resonance signal indicated on a meter or electron-ray tube instead of an oscilloscope.

The frequency can be measured either by the use of a crystal calibrator unit, wavemeter, or with less accuracy by calibrating the dial on capacitor C. Frequency measurement techniques are well known. It should be noted that if the highest precision is to be obtained in field measurement, the shape and type of the sample used must be chosen with care. Water samples with an excessive amount of ferric salts in them sometimes produce a small field shift from the true resonance. Mineral oil samples, though giving a lower signal, have negligible shift[5]. Care must also be used to insure that the sample holder, coil, and shield do not have ferromagnetic impurities.

Magnetic Field Regulation

The nuclear-resonance signal has been used to regulate magnetic fields with good success. It will



Proton resonance line using a water sample adjusted with ferric nitrate

hold the field to less than 10 percent of a line width and since the error signal is obtained directly from the field, it also corrects for changes in geometry and temperature which the customary current regulator will not do.

The complete details of a regulator used to regulate a 35-ton magnet[9] have been shown in Fig. 4. In this case the error signal was used to control the field of the main generator and antihunt was obtained by feeding in series with the error signal a rate voltage obtained from an auxiliary magnet winding of small size wire. Because of the high gain of this system, the rate signal had to be amplified by a single-stage floating d-c amplifier. The effect of this rate voltage circuit was to increase the time constant of the magnet from its normal 8 seconds to 17 minutes. The series control tube shown in the field circuit was actually four 807 tubes in parallel, which were quite adequate for controlling the 500-ma, 400-volt field of the 300-ampere generator.

While the method of antihunt and method of introducing the error signal may vary, depending on the magnet design, the rest of the circuit details shown may be used to regulate any magnet. The nuclear-resonance probe used is a crystal-stabilized negative-resistance oscillator described earlier.

The rest of the circuit shows a typical sweep-voltage source (R-C oscillator plus amplifier stage), narrow-band amplifier (twin-T network), and the phase detector circuit. All of these including power supply are mounted on one chassis, and both filament and plate supply for the probe are also obtained from that chassis. The phase detector will not be discussed further as it has already been described[10].

In putting the circuit into operation for the first time it is advisable to use an oscilloscope for locating the resonance line and making the initial adjustments. When locking the magnet in with the nuclear-resonance signal, a fine field adjustment is required since the resonance line is so narrow that it is quite easy to pass through it so fast that the regulator does not have time to pull in. If the feedback phase is wrong, the regulator will try to regulate on either side of the resonance line instead of the center. This may be easily remedied by reversing the sweep-coil leads.

References

(1) H. A. Thomas, R. L. Driscoll, and J. A. Hipple, *J. Research NBS* **44**, p 569 RP2104, 1950.
(2) N. Bloembergen, E. M. Purcell, and R. V. Pound, *Phys. Rev.* **73**, p 679, 1948.
(3) H. A. Thomas and R. D. Huntoon, *Rev. Sci. Inst.* **20**, p 516, 1949.
(4) Quarterly Progress Report, Research Laboratories of Electronics, MIT April 15, 1950.
(5) A. Roberts, *Phys. Rev.* **72**, p 182, A, 1947.
(6) N. J. Hopkins, *Rev. Sci. Inst.*, **20**, p 401, 1949.
(7) R. V. Pound and W. D. Knight, *Rev. Sci. Inst.* **21**, p 219, 1950.
(8) H. A. Thomas, *Phys. Rev.*, **80**, p 901, 1950.
(9) H. A. Thomas, *Phys. Rev.*, **78**, p 339, A, 1950.
(10) I. A. Greenwood, J. V. Holdam, and D. Macrae "Electronic Instruments" p 383, McGraw-Hill, 1948.

Job Evaluation Chart

Systematic comparison of advantages and disadvantages offered by various employment opportunities ensures more intelligent decisions. Chart shown below illustrates one engineer's system. It can easily be modified to apply to other individuals and jobs

By R. W. JOHNSON

Electronics Engineer
U. S. Naval Ordnance Test Station
China Lake, California

CURRENT FLOODS of advertisements pleading for engineers are often bewildering to the average young electronics engineer. Each hiring concern claims certain advantages in living conditions, working conditions, security, and so on. It is usually difficult to evaluate these claims in the true perspective. It is the purpose of this short article to present a flexible system of engineering job evaluation that might be of assistance to engineers considering a change in employment.

The first step is to list all factors that might enter into the selection of a job. In the second step, these factors are weighted in accordance with some arbitrary scale depending on the importance the individual places on each particular factor. The factors and weightings shown in the example of Table I are arbitrary, representing only the views of a particular individual.

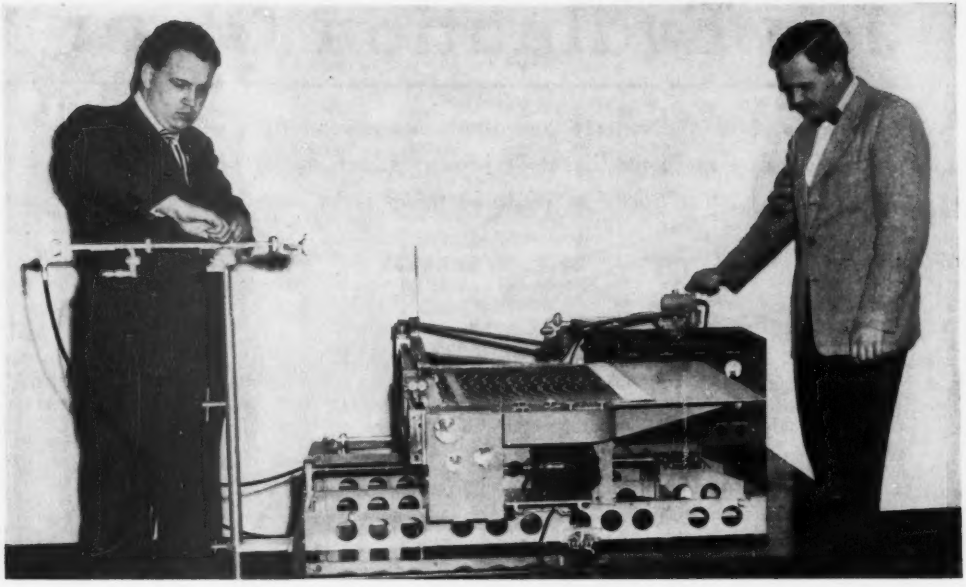
The actual evaluation process consists of considering separately each factor for each job possibility and assigning it an appropriate number with respect to maximum allowable for that particular factor. The results may be tabulated as illustrated in the table. The summation of vertical columns may then be compared with the maximum by any convenient means, the highest sum representing the most desirable situation, and so on.

Particularly close results should be compared separately for more reliable evaluation. The accuracy of the system depends on the amount of thought and effort given to the listing, weighting and evaluating. The latter implies an adequate knowledge of the situation in each case. It is generally desirable, if one has an acquaintance at a particular location, to have him prepare an evaluation as a check.

It is surprising how brown the grass can get on the other side of that fence when this system is applied!

TABLE I—Engineering Job Evaluation Chart

Item	Max. Pts.	Job Possibilities A	B	C	D	E	F
LIVING:							
Weather	20	10	10	5	15	12	20
Housing—cost	15	10	10	5	5	10	15
Housing—availability	15	10	10	10	10	5	15
Housing—location	15	12	11	10	9	7	10
Schools	10	2	10	5	10	10	10
Recreation	10	5	5	7	9	10	5
Traffic	10	5	5	7	8	10	10
Travel to work	10	10	7	6	8	5	5
Moving expense and inconvenience	10	10	10	10	8	6	5
Medical facilities	5	5	5	4	4	4	4
Shopping facilities	5	5	5	4	3	3	5
Neighbors	5	5	5	5	5	5	5
WORKING:							
Supervisor(s)	15	8	7	7	10	15	12
Challenge of job	15	12	14	10	10	10	15
Chance for advancement	20	10	10	15	15	5	20
Prestige of organization	20	15	12	13	18	10	20
Supply and red tape	15	15	12	8	7	15	5
Military relationships	10	10	10	10	7	6	5
Security of future	20	10	5	15	10	5	20
Recognition for work	15	10	10	15	15	10	15
Amount of travel	10	5	5	10	7	8	9
Other opportunities in area	10	10	9	8	6	5	7
Laboratory facilities	15	5	7	10	10	10	15
Policies of organization	20	5	15	12	13	15	15
Salary	30	20	25	30	15	20	20
Value of experience	20	20	10	15	15	15	20
Type of work	20	20	10	15	10	15	20
Totals	385	264	254	271	262	251	327
Percent	100	68½	66	70½	68	65	85



The authors shown operating the automatic phase-front plotter

Automatic Antenna

Automatic device scans 30 by 36-in. plane in front of microwave antenna and plots full-size map showing either phase or amplitude variations in the plane. Accurate plot eliminates difficult mathematical computing in the near-field region

By ROBERT M. BARRETT and MALCOLM H. BARNES

Air Force Cambridge Research Center
Cambridge, Massachusetts

IN THE DESIGN of reflectors, horns, lenses and other microwave optical systems, it is necessary to know the shape of the emerging wave front in some detail. The study of such a wave front provides a powerful tool in the analysis and correction of aberrations of the optical device under consideration.

Directional characteristics of antennas are uniquely determined by the near-field phase and amplitude of the radiated signal. Improved methods of determining these parameters have been sorely needed for some time. The machine described herein not only gives accurate information concerning fields but it also presents it in such a way as to be of maximum utility.

Output from the device is in the form of a pair of pictures of the electromagnetic waves as they exist in a plane section through space. One of these pictures is of the phase of the waves and is very much like a photograph of a series of water ripples in a still pond. The other picture, of the wave amplitude, is essentially a contour map of the magnitude of the waves and is read the same as an ordinary geographical contour map.

These graphical representations are not only of inestimable value to the antenna designer in the detailed analysis of antenna aberrations but are also of great value in providing a quick, accurate mental picture of

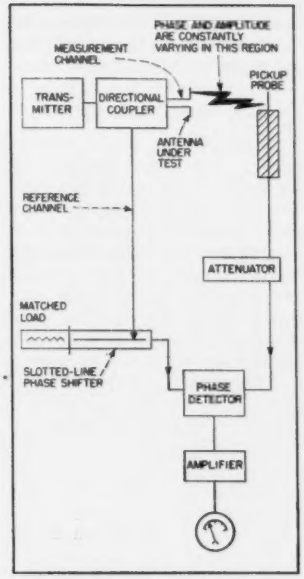


FIG. 1—Manual phase measurement

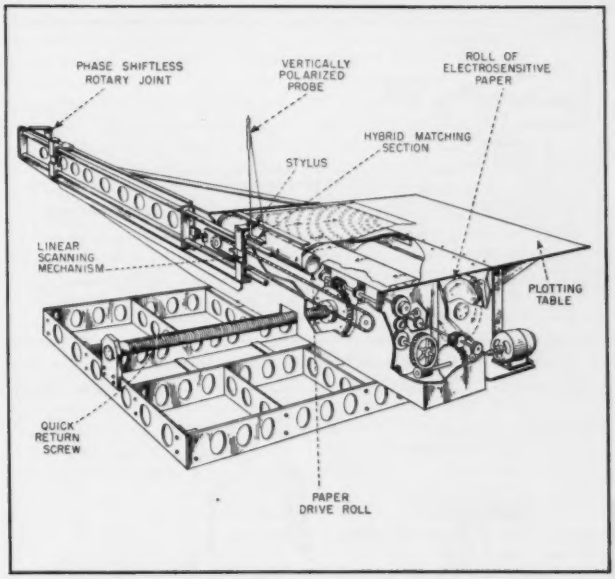


FIG. 2—Cutaway illustration of automatic phase-front plotter

Wave-Front Plotter

the modi operandi of various complex antennas and microwave systems. As an educational tool and an aid to clearer mental concepts of the complexities of electromagnetic propagation, the device has many times proven its worth.

The study of propagation by this technique, where the detailed complexities of refraction, diffraction and reflection can be readily observed, has proven to be particularly fruitful. Even in very complex problems where carefully chosen mathematical approximations and assumed electromagnetic fields are necessary, the available pictures have often saved many laborious hours of computation.

Phase-Front Measurement

The method most commonly employed for phase-front measurements depends upon combining with the pickup probe signal a reference signal of the same frequency and from the same source, whose relative phase and amplitude can be varied independently. These signals are then combined in a phase detector and, keeping the amplitude constant, the phase of the reference signal is varied until the resultant amplitude is minimum. Changes in the phase of the test signal will necessitate equal changes in phase of the reference signal to maintain this minimum.

This method of adjustment of a reference phase for a minimum resultant amplitude is adequately sensitive in practice only if the amplitudes of the test signal and the reference signal are approximately equal. Inasmuch as the amplitude of the test signal will vary over a wide range as the probe is moved through the field, it is necessary to perform continuously a compensating adjustment of the relative amplitude of the test and reference signals. This is a slow and laborious measurement process. Even with provisions for making such an amplitude adjustment, a method of measurement which depends on the adjustment of some variable for a minimum output reading is not entirely satisfactory. This is because small changes in the controlled variable produce only second-order changes in the output when in the neighborhood of a minimum.

In any practical measurement program, it would be necessary to measure the phase and plot several hundred points before a detailed examination of the wave front could be made. As it takes several minutes to make each individual measurement, it can be seen that this method is much too slow and labori-

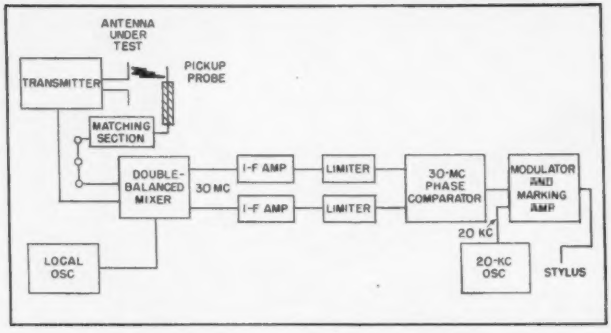


FIG. 3—Block diagram of the plotter system

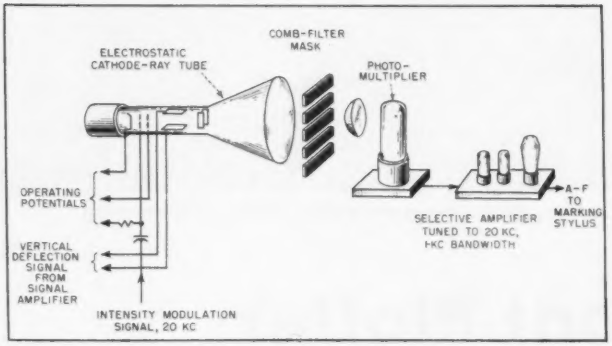


FIG. 4—Operation of comb-type amplitude filter

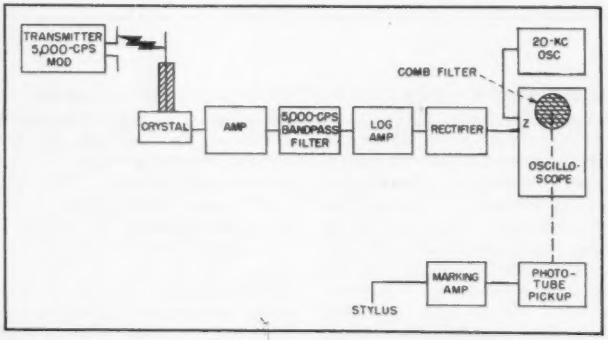


FIG. 5—Block diagram of automatic amplitude-contour-plotter system

ous to be practical in any extensive analysis. There exists a definite need for some form of automatic phase recorder which will automatically perform all necessary balancing and intercomparing functions.

It was the desire of the authors to design and construct equipment that would automatically detect and plot, over a comparatively large area, the phase fronts in a microwave field. It was desired to accomplish these measurements not only in the free-space field but also within solid dielectrics, by scanning close to the surface of the dielectric and utilizing the known relation of the leakage field to the internal field to effectively plot the wave form as it appears within the dielectric.[1]

Automatic Phase Plotting

Phase plotters of the scanning variety were first described by Iams.[2] While his instrument incorporated most of the basic features of an automatic phase-plotting device, it was a rough experimental model and left a lot to be desired in really usable, accurate and automatic phase plotting. The probe scanned the detection space in a circular arc and moved sinusoidally in time, causing a darkening of the chart paper towards the edges of the plot. The basic limitation was, however, the phase comparison mechanism itself. This was sensitive to amplitude fluctuations and would plot phase accurately only over a small range of relative amplitudes.

Since the design and construction of our equipment, another plotter of the scanning variety has been described by Kock.[3] His device used a modulated neon lamp as the stylus and a camera as the recording mechanism. This instrument, however, has the same basic limitation as the Iams plotter in that it is sensitive to amplitude variations.

Referring again to the manual method of measurement, let us examine its essential features as shown in Fig. 1 and consider them in the light of possible adaptation to automatic recording. The r-f source supplies two channels, one passing through the r-f attenuator, the antenna under test and then the pick-up probe, while the other passes through the r-f phase changer. These two signals are then combined and detected, with the resultant output indicated on a meter. The r-f phase shifter, which usually consists of a matched slotted line or some other form of line stretcher, can produce known phase changes of the reference signal by motion of the probe along the slot. Thus, any phase change in the test section can be balanced out by means of the phase changer in the reference channel.

Although simple in principle, this type of phase measurement requires a precision matched phase changer and is very sensitive to changes in

relative amplitude between the two signals. If the phase changer produces an amplitude variation or if, conversely, the attenuator produces a phase shift when the amplitude is varied, it will be extremely difficult to make an accurate measurement. Some commonly used attenuators have as much as 30-deg phase shift for a 10-db amplitude change.

Phase-Measurement Methods

The methods of phase measurement which are adaptable to automatic recording can roughly be divided into methods which accomplish the phase comparison at the r-f test frequency and methods which use heterodyning to make all phase comparisons at a constant lower frequency. Several variations of the former method were investigated and subsequently eliminated for one reason or another. One such system utilized a waveguide magic tee as a phase detector with probe and reference signal inputs. This resulted in the same disadvantages as the Iams and Kock plotters in that it worked comparatively well over a small range of amplitude but when the probe signal fell below the reference signal level, the stronger reference signal made complete phase cancellation at the magic tee detector output impossible.

In order to overcome this limitation, which is basic to several methods, it would be necessary to maintain constant r-f input to the detector. This presupposes a compensating attenuator without insertion phase shift or else with some means for correcting the varying phase shift introduced as constant amplitude is maintained.

In order to overcome the necessity for amplitude compensation and complexity in circuitry at the r-f test frequency, it was decided to use a heterodyne system where amplitude limiting could be accomplished in both channels.

Circuit Design

Figure 2 shows a cutaway view of the automatic plotter finally evolved. Fig. 3 shows the block diagram of the system. The signal picked up by the probe as it scans back and forth in front of the antenna is introduced into a flat-type hybrid matching section of standard size waveguide. From there it is propagated through three waveguide arms and rotary joints. These are necessary to allow for the scan of the probe without utilizing coaxial cable which produces large phase discrepancies when flexed. The rotary joints were, in fact, completely redesigned to introduce no detectable phase shift due to their rotation. The output of the third rotary joint along with the reference signal from the transmitter are fed into their respective inputs in a flat-type hybrid double-balanced mixer which utilizes a single local oscillator tube to preserve phase coherence.

The two outputs from the mixer, at an i-f value of 30 mc, are fed into two high-gain i-f amplifiers. These amplifiers have a negligible phase shift over a 40-db input variation and are maintained under identical conditions. At the amplifier outputs there are two signals, one constant and the other varying in amplitude. In order to eliminate the phase errors or the necessity for complex balancing systems imposed by variations in amplitude mentioned previously, two stages of limiting were introduced at the output of each i-f strip. The limiter outputs are constant and equal in amplitude over a 40-db input range and vary only in phase as the probe scans. These two signals are then applied to a 30-mc phase comparator which consists of a single diode phase detector. The output of this comparator depends on the phase relation of the two input signals with zero output when the inputs are 180 deg out of phase.

Inasmuch as an a-c high-frequency voltage is necessary for marking the electrosensitive chart paper used, the d-c comparator output is used to modulate the 20-kc oscillator output, which is amplified and applied to the paper by means of a stylus. The pickup probes utilized are three in number: E-field vertical and E-field horizontal polarization and horizontal H-field. The probes consist of a miniature coaxial line (0.033-in. outer-conductor diameter) which is encased in a ¼-in. diameter rod. At the pickup end there is a series of dielectric loaded decoupling chokes to prevent currents from being set up along the surface of the rod. At the opposite end of the probe, there is a standard type N connector.

After reviewing the characteristics of other types of phase-measuring and phase-plotting devices and after studying the various types of micro-wave fields to be investigated and the type of information required, minimum specifications for a phase-measuring device were evolved. The scan should be linear in time and space. The scanned area should not be less than 30 by 36 in. The device should give a quantitative picture of the entire r-f field in the region of interest. The recorded information should be of such accuracy that it can be used for careful qualitative analysis and design. The device should plot amplitude in the near-field region.

Drive System

With a 30 by 36-in. scan it is possible to plot over a comparatively large area, which is especially advantageous when using this equipment to investigate wide-aperture antenna systems such as lenses, linear arrays and pillboxes. The linear time scan readily eliminates the darkening of chart paper at the edges of the plot. The linear space scan has proven invaluable in scanning close to antennas such as linear arrays and diffraction gratings, rather than approaching only at one point as was the case when the scanning probe moved along a circular path.

To meet the above specifications, a special chain drive with a chain guide pin was designed for the probe and stylus scan. This unique method gives a linear scan over the distance between the vertical centers of the two-chain sprockets which is also the width of the chart paper and when driven with a constant-speed motor produces a scan which is linear in time and space. With each scan of the probe, the chart table and chart are so geared to the probe drive that they roll and move away from the antenna under test approximately one sixty-fourth of an inch. In this way, over a length of chart paper there is a series of closely spaced parallel lines simulating a television-type scan.

As first envisioned, this equipment was only intended for the

measurement of r-f phase. However, upon completing the phase-comparison mechanism it was decided to adapt this equipment to plot amplitude contours in the near-field region. In this way, the fields can be probed and the amplitude distribution plotted about the focal regions of lenses and reflectors. To calculate the fields in this near-field region is a complex mathematical problem. Furthermore, little has been done in the past in making precise experimental measurements because of the difficult measurement procedure necessary. Amplitude contour plots supplemented by phase plots made with the equipment described give a fairly complete picture of the near field which can be readily correlated with standard far-field radiation patterns.

As the plotting table and the scanning mechanism were readily adaptable to power contour plotting, this extension of the equipment was primarily a problem in new circuitry.

The major problem in producing amplitude-contour plotting is in obtaining the output necessary for such a device to operate. This is accomplished by feeding the a-m signal through a comb-type amplitude filter which produces an output only when the input signal is at a series of prescribed amplitude levels. Several types of such filters were studied before the cathode-ray type was finally evolved and used. Referring to Fig. 4, this filter operates as follows: The detected signal is applied to the vertical deflection plates of a crt in such a way that the vertical deflection is proportional to the logarithm of the input signal. At the same time, a 20-kc intensity modulation is applied to the electron beam. The face of the crt is covered by an opaque mask containing a series of regularly spaced slit openings. The light output from these openings is detected by a multiplier phototube, amplified and then applied to the marking stylus which burns amplitude contour lines into the paper corresponding to the amplitude levels passed by the slit apertures in the mask. Thus, a continuously varying input is characterized by a series of discontinuous pulses corresponding to prescribed amplitude levels.

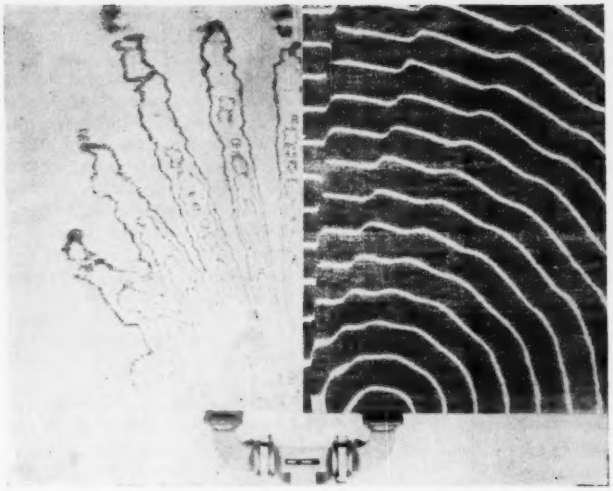


FIG. 6—Amplitude and phase plot of two point sources

Figure 5 shows the block diagram of the amplitude plotting system. The transmitter signal is modulated at 5,000 cycles and detected at the output of the pickup probe. The detected signal is then amplified and introduced into a narrow-band 5,000-cycle filter. After passing through a logarithmic amplifier, it is rectified and applied to the plates of a crt which is intensity-modulated at 20 kc.

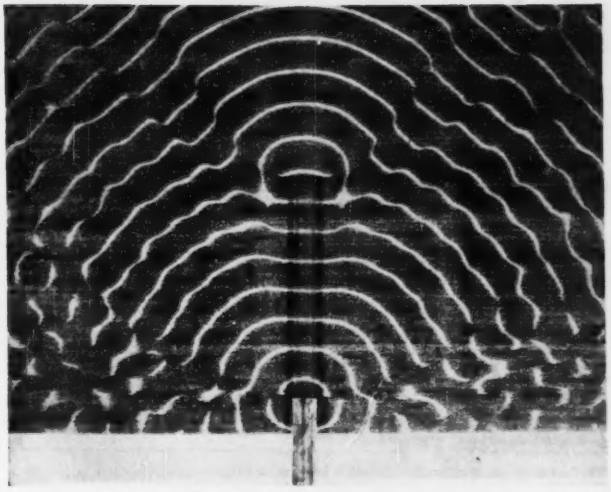
The comb-filter mask is placed over the screen of the crt. In practice, this mask consists of narrow pieces of black photographic tape placed on the face of the tube. As the level of the rectified input to the oscilloscope varies and the spot on the screen passes a slit in the mask, the photomultiplier tube is energized. The output from the phototube is amplified to the potential necessary to mark the paper and is applied to the stylus.

The amplitude plots produced by this method are a series of amplitude contour lines, the number depending on the number of apertures in the filter mask. The levels can be calibrated in order that a contour line will appear for every specified decibel level.

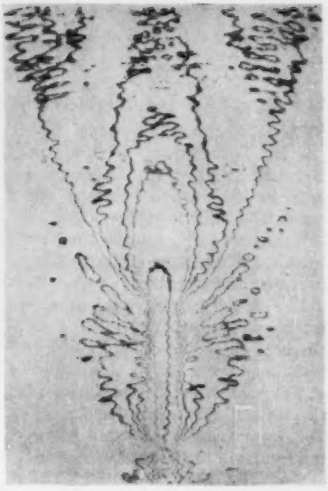
Figure 6 shows a combination of amplitude contours and phase plots of two point sources spaced approximately five wavelengths apart. However, either one plot or the other is actually obtained from the machine at any one time. In the amplitude section, the left half, the lobe structure can be seen and correspondingly whenever a null appears between lobes a phase discontinuity is present in the phase plots of the right half.

Applications

As an example of the use of the machine described above, in the study and analysis of the operation of antenna systems, the plots from a few simple antennas are presented. The plots of the radiation from two point sources, shown in Fig. 6, are typical of the results to be expected from the machine and give a good idea of the average resolution obtained with the equipment in its present form. Modifications now under way are expected to improve the resolution to a marked degree. As can be seen in the amplitude half of the plot, the near-field amplitude pattern of the two point sources is remarkable in that the far-field radiation characteristics with the many lobed patterns are so readily apparent even in the comparatively near-field region. The deep nulls of the amplitude pattern are characterized in the phase half of the plot by sudden 180-deg phase discontinuities.



Phase plot of a polyrod antenna



Amplitude plot of a polyrod antenna

It should also be noted that incomplete nulls are represented in the phase pattern by smaller discontinuities. For shallow nulls a mere ripple appears in the phase front.

The phase pattern of the polyrod antenna shows the characteristic flattening of the wave caused by the phase retardation of energy in and around the polyrod itself with respect to the free-space propagation. The particular polyrod illustrated was so designed that only a comparatively modest amount of energy was radiated from the rod itself, while a large portion of the energy is transmitted to the end of the rod where it is radiated as if from a point source.

The interference of these two radiated signals produces the characteristic hyperbolic interference pattern seen in the figure. This is easily verified from the amplitude plot of this antenna which indicates small radiation along the rod (note rapid lateral amplitude taper) and thus demonstrates the guiding action of the rod. The greater portion of the energy emanates from the end section of the rod and radiates. The phenomenon of isolated amplitude islands is readily apparent.

The phase plot of a typical end fire type metal-clad dielectric antenna is included in Fig. 7. By photographing the phase plot along with a drawing of the antenna, a complete pictorial representation of the phase structure and end-fire characteristics of such an antenna system can readily be seen.

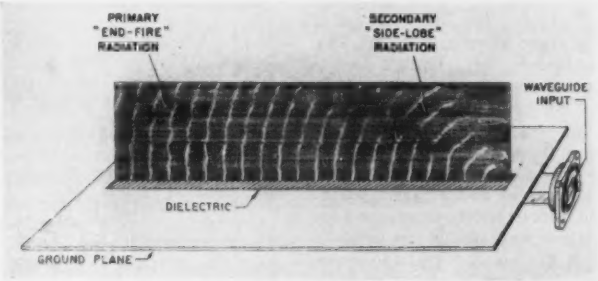


FIG. 7—Phase-front contours of a metal-clad dielectric antenna

The phase-front plotter, as described, is a valuable piece of laboratory equipment for antenna research work. When various types of discontinuities are introduced in solid dielectrics and the probe is scanned close to the surface of the dielectric, the effects of these discontinuities are clearly shown in the plots. In addition, various microwave optical experiments and measurements heretofore impossible or very difficult to conduct are made practical by use of this equipment. Lenses, prisms, multiple-sources and shadow problems are only a few of those which can be completely investigated using the combination phase and amplitude features of the plotter.

The flat-type hybrid used in the equipment design is a development of Dr. Riblet, Microwave Development Laboratories, Waltham, Mass., and the method of amplitude plotting used herein was first suggested and experimentally verified by Walter Rotman.

References

(1) Harley Iams, A Method of Simulating Propagation Problems, *Proc. IRE*, **38**, p 543, May 1950.
(2) Harley Iams, Phase-Front Plotter for Centimeter Waves, *RCA Review*, **8**, p 270, June 1947.
(3) Winston Kock, Photographing Sound Waves, *Bell Laboratories Record*, **28**, p 304, July 1950.

Specifications for

THE National Television System Committee released on Nov. 26 the text of 22 technical specifications which describe the compatible color television signal to be field tested over stations in New York, Philadelphia, Washington, Syracuse and Chicago.

The specifications were unanimously approved by the NTSC as the best basis for conducting field tests but have no other significance at this time. Upon the conclusion of the tests, the specifications, modified if necessary in accordance with the results of the tests, are expected to be finally approved by the NTSC and may then be offered to the FCC as proposed standards for compatible color television.

The specifications are divided in two groups. The first consists of nine items summarizing the FCC standards for black-and-white transmission as presently authorized for commercial stations.

The second group consists of 13 specifications related to the transmission of color values.

Reports of participation in the field tests by technical personnel are solicited and should be sent to W. R. G. Baker, NTSC Chairman, care of General Electric Co., Syracuse, New York.

The full text of the test specifications follows:

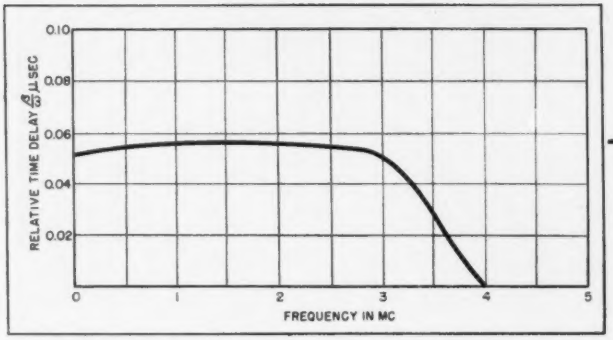


FIG. 1—Delay characteristic of network for compensation of phase distortion associated with cut-off in receiver. Relative time delay versus frequency characteristic of radiated envelope is to be held within + 30 percent and — 0 percent. Ordinate scale may be multiplied by a factor of 1.0 to 1.5

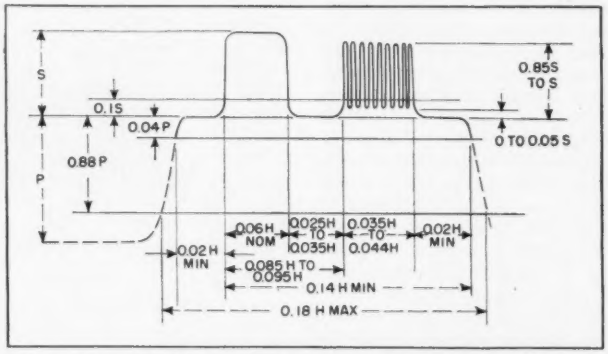


FIG. 2—Color synchronizing signal. This waveform is that which exists at the studio before transmission over limited bandwidth circuits. The burst follows each horizontal pulse. It is omitted following the equalizing pulse and during the broad vertical pulse. Vertical blanking is 0.07 to 0.08 of the vertical scanning period

Group I (Summary of FCC Standards)

1. The image is scanned at uniform velocities from left to right and from top to bottom at 525 lines per frame, 60 fields per second, interlaced 2 to 1.

2. The aspect ratio of the image is 4 units horizontally and 3 units vertically.

3. The black level is fixed at 75 percent (± 2.5 percent) of the peak amplitude of the carrier envelope. The maximum white (brightness) level is not more than 15 percent of the peak carrier amplitude.

4. The horizontal and vertical synchronizing pulses are those specified in Appendix I of the FCC Standards of Good Engineering Practice Concerning Television Broadcasting Stations (for black-and-white transmissions, dated Dec. 19, 1945 as amended Oct. 19, 1950), modified to provide the color synchronizing signal described in specification 21 (Group II).

5. An increase in initial light intensity corresponds to a decrease in the amplitude of the carrier envelope (negative modulation).

6. The television channel occupies a total width of 6 mc. Vestigial-sideband amplitude - modulation transmission is used for the picture signal in accordance with Appendix II of the FCC Standards of Good Engineering Practice.

7. The sound transmission is by frequency modulation, with maximum deviation ± 25 kilocycles, and with preemphasis in accordance with a 75-microsecond time constant.

8. The radiated signals are horizontally polarized.

9. The power of the aural-signal transmitter is not less than 50 percent nor more than 150 percent of

Color TV Field Tests

NTSC releases 22 specifications descriptive of the compatible color signal to be used in forthcoming tests in five cities, urges participation of all interested industry organizations and technical personnel. Signal employs constant-luminance sampling, color phase alternation, and a color subcarrier frequency of 3.898125 mc

the peak power of the visual-signal transmitter.

Group II (Supplementary)

10. The color signal has the following composition

$$E_m = E'_y + \frac{1}{1.14}\left[\frac{1}{1.78}(E'_B - E'_y)\sin\omega t + (E'_R - E'_y)\sin(\omega t \pm 90°)\right]$$

where

$$E'_y = 0.59\,E'_G + 0.30\,E'_R + 0.11\,E'_B$$

In this expression the symbols have the following significance:

E_m is the total video voltage, corresponding to the scanning of a particular picture element, applied to the modulator of the picture transmitter.

E'_y is the gamma-corrected voltage of the monochrome (black-and-white) portion of the color signal, corresponding to the given picture element. This signal carries all of the luminance information.

Gamma-corrected voltages E'_G, E'_R, and E'_B correspond to the green, red and blue signals intended for the color picture tube, during the scanning of the given picture element. Value ω is 2 π times the frequency of the color carrier. The phase reference of this frequency is such that the color synchronizing signal (see specification 21 below) corresponds to an amplitude-modulated signal of the form cos ωt, where t is the time.

The plus or minus sign near the end of the expression indicates that the phase of this component is alternately advanced and retarded by 90 degrees on successive scanning fields with respect to the stationary color phase alternation axis, (see specification 20 below).

The portion of the expression between brackets represents the color subcarrier signal which carries the chromatic information.

It is recommended that field-test receivers incorporate a reserve of 10-db gain in the chromatic channel over the gain required by the above expression.

11. The primary colors referred to by E'_R, E'_G, and E'_B have the following chromaticities in the ICI system of specification:

	x	y
Red (R)	0.67	0.33
Green (G)	0.21	0.71
Blue (B)	0.14	0.08

12. The color signal is so proportioned that when the color subcarrier vanishes, the chromaticity reproduced corresponds to illuminant C ($x = 0.310$, $y = 0.316$)

13. Gamma correction is such that the desired pictorial result is obtained on a display device having a transfer gradient (gamma exponent) of 2.75. However, the equipment used is capable of an overall transfer gradient of unity. The voltages E'_y, E'_R, E'_G and E'_B in the expression in specification 10 refer to gamma-corrected signals.

14. The color subcarrier frequency is 3.898125 mc ± 0.001 percent, with a maximum rate of change not to exceed $\frac{1}{2}$ cps per sec.

15. The horizontal scanning frequency is 2/495 times the color subcarrier frequency. This corresponds to 15,750 cps.

16. The bandwidth assigned to the monochrome signal E'_y is in accordance with the FCC standard for black-and-white transmissions.

17. The bandwidth assigned prior to modulation to the chromatic signals (E'_R—E'_y) and (E'_B—E'_y) is not less than 1 mc at 6-db attenuation. A gradual cutoff characteristic is required to be used.

18. The bandwidth assigned to the modulated color subcarrier extends to at least 1 mc at 6-db attenuation below the color subcarrier frequency and to at least 0.4 mc at 6-db attenuation above the color subcarrier frequency.

19. To assure that all the components of the color signal shall coincide in time at the second detector of the receiver, delay compensation is used such that a sinewave, introduced at the transmitter color-signal input terminals, produces a radiated envelope having a relative time delay-vs-frequency characteristic within + 30 percent and − 0 percent of that specified in Fig. 13 of RMA report TS 1.2-3005-A (Figure 1 herewith), except that the ordinate scale may be multiplied by a factor of 1.0 to 1.5.

20. The color phase alternation implied by the (±) sign in specification 10 is such that the color subcarrier phasor representing (E'_R—E'_y) shall lead the phasor representing (E'_B—E'_y) during the scanning field following the vertical sync pulse in diagram (1) of Appendix I of the FCC Standards of Good Engineering Practice Concerning Television Broadcasting Stations, Dec. 19, 1945, and shall lag following the vertical sync pulse shown in diagram (2) of that Appendix. The stationary axis of the color phase alternation corresponds to the (E'_R—E'_y) phasor.

21. The color synchronizing signal is that shown in Fig. 2. This signal corresponds to amplitude modulation of a continuous sinewave of frequency $\omega/2\pi$.

22. Signals outside the assigned channel shall have a level at least 60 db below the peak visual signal amplitude.

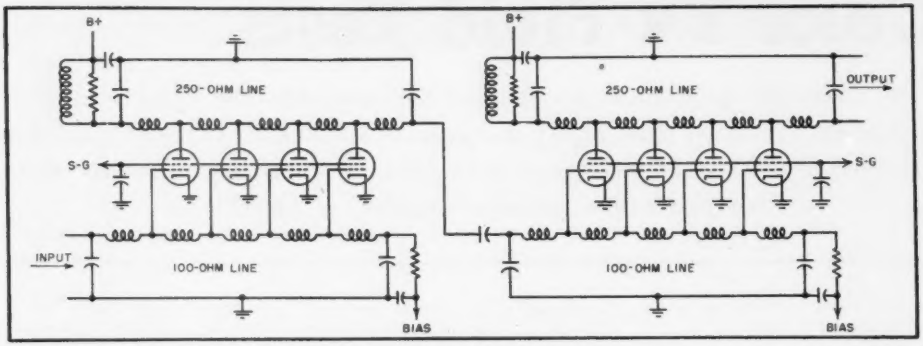


FIG. 1—Circuit diagram showing interconnection of two banks of the distributed-line amplifier. The tubes are all type 4X150A, matched by groups for high and low emission

SHORT-PULSE

Twelve-tube distributed-line amplifier uses three cascaded banks of four 4X150A power tetrodes. Novel circuit layout using standard parts has bandwidth from 1 mc to 100 mc and produces voltage gain of 40 db for oscilloscope presentation of 1-volt pulses

By GEORGE F. MYERS
Naval Research Laboratory
Washington, D. C.

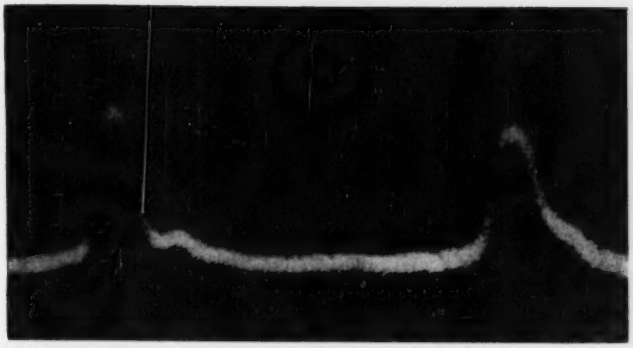
THE distributed-line amplification principle can be successfully used for the amplification of short pulses in the order of 10 millimicroseconds using conventional tubes. For pulses considerably shorter than this, conventional tubes no longer satisfy circuit requirements. The amplifier to be described is designed to handle a 15-millimicrosecond pulse, taking it from the one-volt level to one sufficient for oscilloscope presentation. The oscilloscope itself is an experimental model capable of showing pulses in the order of 5 millimicroseconds with negligible jitter.

Design Considerations

The selection of a tube for this circuit is limited to a rather small field since circuit requirements call for a wide frequency response, tetrode or pentode construction, high transconductance, high-current capabilities, low input and output capacitances, and if possible, double-ended construction. The 4X150A power tetrode was selected as having a sufficient number of these qualifications. Its high input capacitance is offset by its good transconductance figure and its high-current capabilities. As a double-ended tube, it is free from oscillation problems.

It was decided to use one tube model throughout in this amplifier for the sake of simplicity in power supply requirements and to standardize construction. The selection of this tube then resulted in an arrangement of three banks in cascade, with four tubes per bank.

The schematic form of two of these banks in cascade is shown in Fig. 1. Plate and grid lines are constructed with basic pi-section, constant-k, low-pass filter units. A fundamental property of this type of unit is the manner in which its impedance varies with frequency. It is nearly constant over the lower portion of the pass-band (square root of L/C) and rises sharply at the upper end of the pass-band, approaching infinity as the frequency approaches cutoff, for the lossless condition. Thus the gain of the amplifier will rise with the impedance of the filter sections used in the line construction as the cutoff frequency of these lines is approached. This is the origin of the expression "rising gain characteristic" associated with this type of amplifier. Rather than trying to offset this impedance variation and the accompanying phase nonlinearity in the upper region of the pass-band, the line pass-band is arbitrarily chosen as 1.5 times the



Comparison between 0.015-microsecond pulse directly viewed (left) and delayed and amplified (right), showing how little it is distorted in the amplifier

AMPLIFIERS

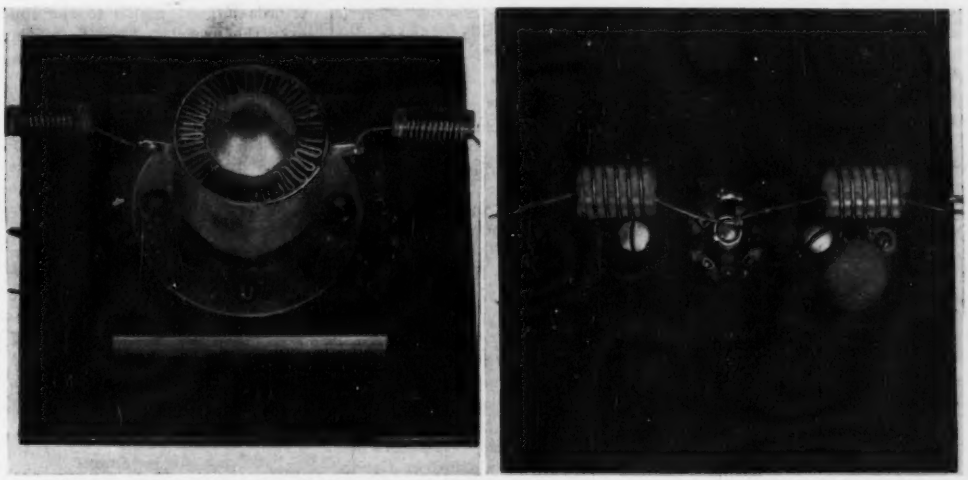
desired useful bandwidth. The end result is a better impedance match and a more linear phase response over the useful bandwidth.

As is indicated in Fig. 1, grid and plate capacitances are used unpadded as the intermediate shunt arms of the line filters. Filter theory indicates that for a given bandwidth, the magnitude of the line impedance is an inverse function of the shunt-arm capacitance, hence the unpadded plate and grid values of capacitance used will result in maximum impedance possible for the two lines. Since the plate capacitance is smaller, its line impedance will be larger than the grid line. These maximum values of impedance will result in maximum gain per bank. There are three possibilities for cascading when starting out with unequal impedances.

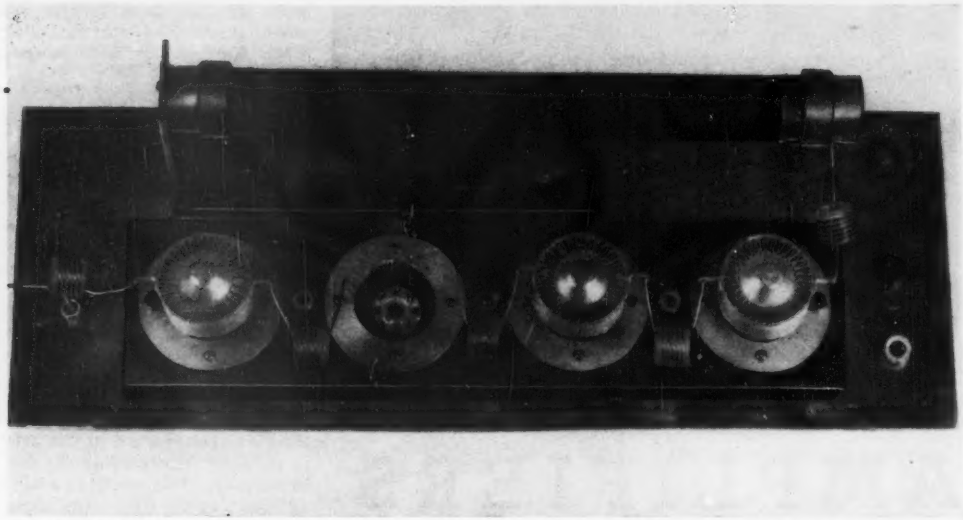
Coupling Systems

The first, transformer action, is ruled out because of the frequency bandwidth, but it can be seen that this ideal method of cascading would result in a voltage loss proportional to the square root of the ratio of the two unequal impedances. The second method would be to reduce the impedance of the plate line to that of the grid line, resulting in a loss in voltage directly proportional to the ratio of the two impedances before reduction. The third and best method in this case is purposely mismatching the two impedances. This results in a voltage less than the ideal transformer method but greater than the equal-impedance method.

No *m*-derived matching sections or half-sections were employed in the line construction and terminations. The manufacturer's tolerances for this tube are such that little can be gained by the use of such sections unless trimming of these capacitances is employed. Although amplifier performance could be improved by this method it operates successfully without matching. This permits greater



Screen-block construction (left) uses insulated chunk of metal above chassis as bypass for screen supply. Underside of block (right) shows positive ground on some tube pins and short projection of grid pin in center



Four-tube bank with one tube removed to show pin connections. Three banks stacked vertically constitute complete amplifier

freedom in standard construction and tube replacement.

The bias-control voltages for all three banks are developed in a common regulated negative supply. Each bank has a separate bleeder circuit that supplies a variable negative bias voltage to each grid line through the terminating resistor. Because groups of four tubes must operate with the same bias voltage, it was found advisable to group all new tubes on initial test into two classes, high-emission and low-emission tubes, using only like-classified tubes in any one bank. This helps to limit the current spread among tubes in a bank.

Equipment Layout

One of the construction features of this amplifier is the screen-block construction illustrated, used to form a low-inductance tube socket. Advantage is taken of the fact that this tube has a ring contact for the screen-grid element between the base and plate end of the tube. A solid block of metal ⅜-inch thick is insulated from the chassis in such a way as to form a good high-frequency bypass capacitance for the screen-supply voltage at which the block is maintained. The tubes are then inserted in spring mounts placed through this block. Contact is made to the plate of the tube by soldering the coils to small projecting lugs on a close-fitting sleeve placed over the plate finning.

The base pins of the tube project into small holes in the ¼-inch brass chassis. Pins to be grounded fit into small spring clips soldered to the edge of the close-fitting hole, while clearance is given the other pins. Clearance for the ungrounded filament pin is such that contact can be made to this pin by means of a small clip.

The grid pin in the center has sufficient clearance to prevent excessive capacitance coupling to the chassis. This is the only other pin on the base to be contacted and again this is done by means of a small spring clip.

Grid coils are space-wound on ¼-inch polystyrene tubing, 8 turns to the inch, while plate coils are space-wound on ¼-inch polystyrene rod, 12 turns to the inch. Plate coils are purposely given a different distributed capacitance figure by geometrical design to help offset the rising gain characteristic of this amplifier.

Table I—Specifications

Bandwidth	1 mc to 100 mc
Voltage Gain	40 db
Output Voltage	±160 volts
Input Impedance	100 ohms
Output Impedance	250 ohms

The reverse-termination resistor assembly illustrated makes use of the high-frequency bypass properties of a large plate of metal insulated from the chassis. This plate is maintained at B+ supply potential. To this plate is added capacitance for the purpose of broad-banding its bypass properties and on this plate is mounted the standoff bracket for the reverse-termination carbon-film resistor. This resistor affords a good match to the line over the useful bandwidth of the amplifier and if air-cooled will dissipate 200 watts when conducting the plate current to the tubes. This dissipation is avoided by winding a single-layer helix of No. 27 enameled wire on the outside of this carbon resistor from one end to the other and connecting the winding electrically in parallel with it. This provides a good low-resistance path for the direct current supplied the tubes and does not materially affect the frequency response of the amplifier above 500 kc. The range of pulses considered is amplified as well with this shunt-fed method as with the direct method of supplying d-c to the tubes.

Bank Arrangement

A standard four-tube bank, with one tube removed for display pur-

poses, is shown in the photograph. In operation, the banks are stacked in a vertical plane and a two-inch hole is left in the chassis near the base of the plate resistor standoff to permit feeding the output of one plate line into the input of the next grid line. The signal order is down the first or bottom bank, back in the next bank up, and down the top bank to the output end. Four such banks have been operated successfully in cascade for test purposes, while standard operation of three banks has continued over a period of months. It was found advisable, when cascading, to stagger the line cutoff frequency of any one bank 5 mc above or below the cutoff frequency of the preceding bank, to prevent the rise in gain peak occurring near cutoff from cascading sufficiently to cause oscillation.

Amplifier Performance

The phase response for an amplifier of this type is indicated in Fig. 2. This property is difficult to determine over such a broad band of frequencies so the alternate method of calculating the response is chosen. By taking the deviation per section from linear phase response and multiplying it by the number of sections in the signal path, an overall phase deviation figure is arrived at. This method of phase analysis stresses two points—keep the number of sections in the signal path low and keep the ratio of useful bandwidth to line bandwidth low.

The response of this amplifier to a 15-millimicrosecond pulse is illustrated. By feeding signals to both deflecting plates of the oscilloscope and suitably delaying the signal to one of these plates, both the input and the output pulse of the amplifier under test are shown on one trace. The delayed pulse to the amplifier was attenuated sufficiently to give the amplifier output pulse the proper voltage for comparison with the input shape. With this 15-millimicrosecond pulse, it can be shown that the amplifier distorts the pulse less than does fifty feet of 90-ohm coaxial cable.

The general specifications are listed in Table I. Undistorted output voltages of 160 volts, both positive and negative, are possible with this combination of twelve tubes, with an input signal in the order of two volts. Operation level of 200 milliamperes per tube proved successful, giving a total current of approximately 2.5 amperes at 400 volts for the amplifier. Tube failures were rather frequent until care was taken to insure that filament operation did not exceed 6 volts. After this, only occasional failures were recorded, chiefly during the first hour of the life of the tube. Bias control proved to be an effective means of gain control over a limited range, while variation of the supply voltage for gain control purposes was ruled out owing to the tetrode design of the tube. The main precaution used in the operation of this amplifier, as previously mentioned, was the grouping of tubes into high-current and low-current classes, with the separation of the banks into these classes for the purpose of tube replacements.

Amplifier Limitations

Consideration was given to the maximum bandwidth possibilities of this circuit with the 4X150A tube. Input conductance tests indicate an upper bandwidth limit around 350 mc. In this region the tube input begins to look inductive and can no longer be used as a capacitance shunt-arm without compensating circuits. One breadboard model was tested out to 250 mc with moderate gain, amplifying 5-millimicrosecond pulses. For the best frequency response curve with this circuit and tube combination, there is an optimum cutoff frequency if gain is not the chief consideration. At around 280 mc, the input conductance losses tend to offset the rising gain characteristics of this circuit, and a relatively flat frequency response curve will be achieved with this cutoff.

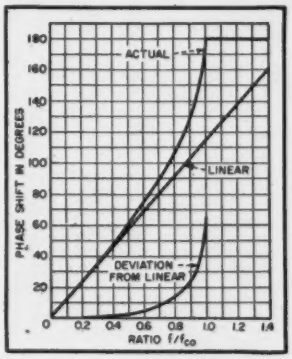
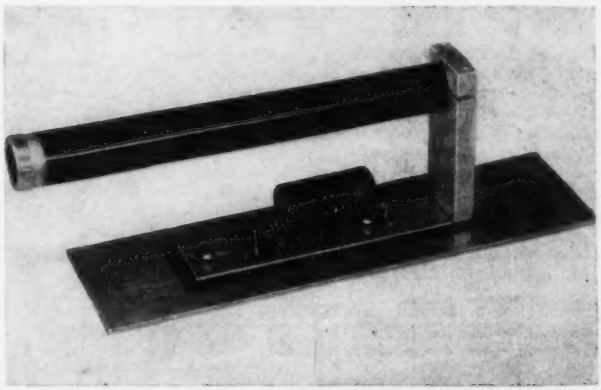


FIG. 2—Phase shift per section of the constant-k filter



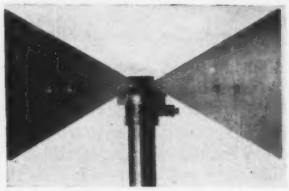
Reverse-termination resistor assembly uses capacitor mounting as one plate of bypass capacitor to chassis

The writer wishes to express his appreciation to I. W. Fuller, who through diligence and care has eliminated many errors and contradictions from this paper.

Reference

(1) Edward L. Ginzton, William R. Hewlett, John H. Jasberg and Jerre D. Noe, Distributed Amplification, Stanford University Microwave Laboratory Report.

UHF Receiving Antennas

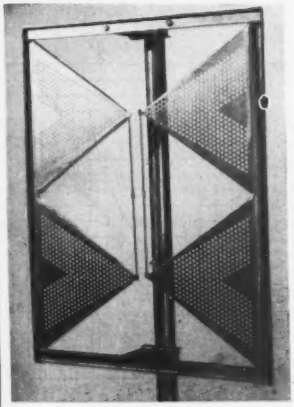


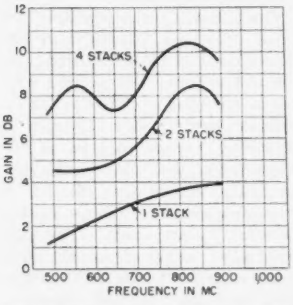
Field tests of wide variety of antennas for 470 to 890-mc uhf television band reveal that the five types shown here are outstanding in performance yet low in cost. All work into 300-ohm line

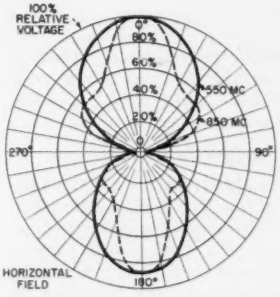
By E. O. JOHNSON and J. D. CALLAGHAN

Advanced Development Section, RCA Victor, Camden, N. J.

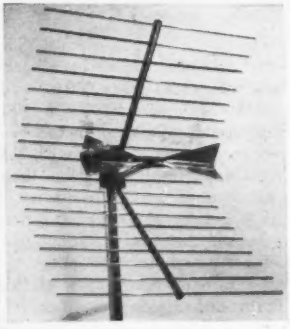
RCA Service Company, Gloucester, N. J.



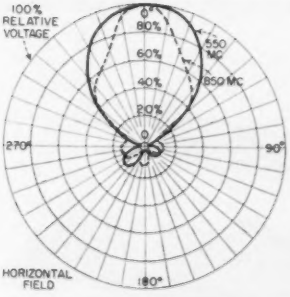


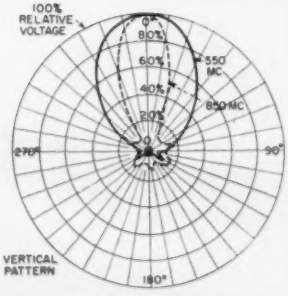


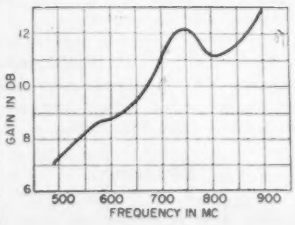
FAN DIPOLE, simplest of all uhf receiving antennas, requires only two triangles of metal supported by an insulating bar. Dipoles are set in metal frame for stacking, which with proper phasing gives greatly increased gain. Bandwidth is excellent. Stacking narrows vertical directivity but does not affect horizontal directivity. Four-stack unit uses two two-stack units connected by twin-lead



CORNER REFLECTOR having 90-degree included angle, using fan-dipole element also folded at 90 degrees, gives ultimate in gain for its compact size. It should be one of best fringe-area uhf antennas, being truly unidirectional in both horizontal and vertical planes. Negligibly small unwanted lobes minimize reflection and multipath troubles. On all gain curves here, 0 db reference is gain of thin half-wave dipole adjusted to resonance at each frequency and matched into 300 ohms







Type of Transmission Line	Loss in db per 100 feet					
	100 mc		500 mc		1,000 mc	
	Dry	Wet	Dry	Wet	Dry	Wet
Standard 300-Ohm Flat Line	1.2	7.3	3.2	20.0	5.0	30.0
Tubular 300-Ohm Line	1.1	2.5	3.0	6.8	4.6	10.0
RG 59/U Coaxial Cable	3.7	...	9.6	....	14.5	....
RG 11/U Coaxial Cable	1.9	...	5.2	...	7.8	...

(Continued on p 134)

Cinch
ELECTRONIC COMPONENTS

Photographs are one-half size, one fourth area of original terminal boards.

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. . . Something of the scope of the Cinch operation in the design and production of electronic components is indicated by these photographs of terminal boards fabricated to meet exacting Armed Forces requirements.

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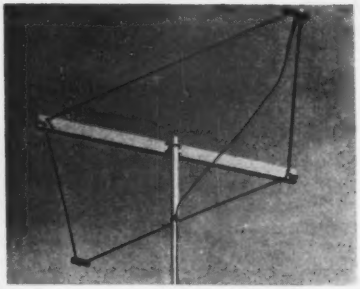
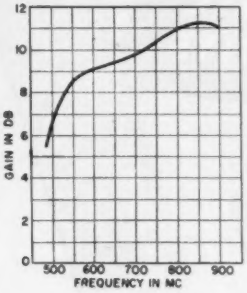
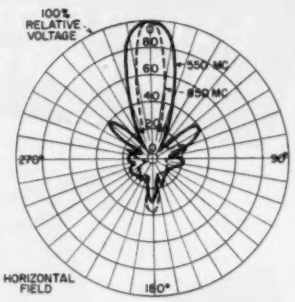
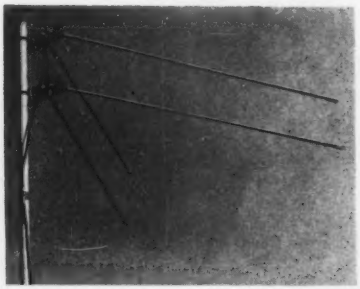
UHF Receiving Antennas (continued from page 132)

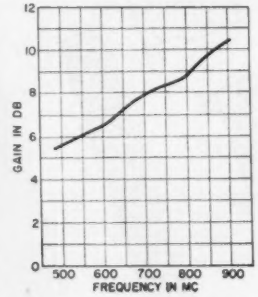


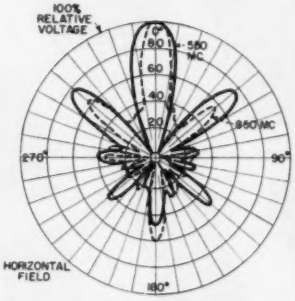




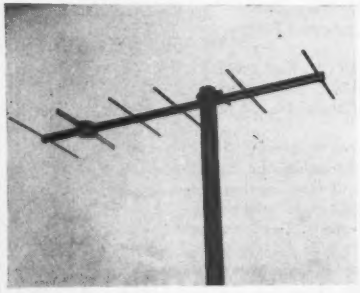
RHOMBICS more than several wavelengths on a leg proved highly successful in uhf field tests when adjusted and terminated for unidirectional operation. Gain is adequately high for fringe areas. Major forward lobe is quite narrow and decreases with frequency as shown. Major vertical lobe, not shown, is about three times as broad as corresponding horizontal lobe. Minor side and back lobes may give trouble in severe cases of reflection or multipath reception. Stacking two of these rhombics 12 inches apart increases gain 2 db across entire band and increases vertical directivity but does not affect horizontal directivity. Rising gain characteristic with frequency is desirable

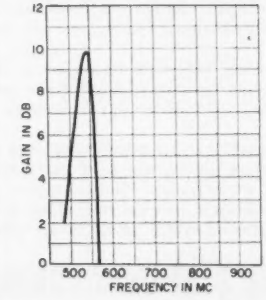


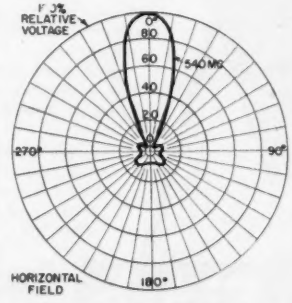




STACKED V antenna uses same rods as standard dipole cut for channel 2 and thus contains about same amount of metal as simple vhf dipole and reflector. Efficiency is good considering simplicity of construction and ease of mounting on existing masts. Gain is high enough for medium and weak signal areas and increases desirably with frequency to overcome propagation and transmission-line losses that increase with frequency. Bandwidth is excellent, but directivity pattern shows lobes that restrict use to areas reasonably free of reflections. Chief trouble with regular vhf antennas on uhf is large number of such secondary lobes and fact that major lobe is usually off the antenna axis







YAGI antennas give more gain for size and weight than any other type of uhf antenna, if close dimensional tolerances are held during construction. Unit shown is 6-element wide-spaced type with 28-inch overall length. Though gain shown is adequate for most weak-signal areas, stacking gives still higher gains. Peak gain is obtained only on one channel, but total of 7 uhf channels can be covered with sacrifice of only 3-db gain at ends of pass band. Helical and slot-type antennas also adapt readily to uhf use. A balun is used for matching to coax and also gives lightning protection if its shell is adequately grounded. Standard lightning arresters have excessive losses at uhf

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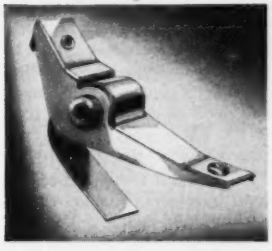

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TUBES AT WORK

Including INDUSTRIAL CONTROL

Edited by RONALD K. JURGEN

1,000-Cycle Warning Device 136
Ground-Transmitter Klystron for Air Navigation 136
Submerged Repeaters for Telegraph Cables 164
Automatic Steering for Outboard Motorboats 172
F-M Performance Measurement Form 192
Tunable Selector-Rejecter for Audio Amplifiers 196

1,000-Cycle Warning Device

By PHILIP WHITNEY

Chief Engineer
Stations WINC and WRFL
Winchester, Va.

THIS EASILY CONSTRUCTED monitoring device has proven foolproof and positive in action, supplying two types of warning signals, a loud 1,000-cycle tone and a loud bell or brilliant warning light. The latter two are optional but it is recommended that they be included especially in an application where the operator or announcer must concentrate on other duties. The parts for the unit are easily obtainable receiver parts and two surplus tuned audio circuits from the Hammarlund Fleet-Control units.

The input is arranged to bridge a 600-ohm line with no appreciable attenuation. The input coupling transformer is a common, interstage receiver audio transformer with a 2,700-ohm resistor in each leg. The high-mu triodes were used because of the simplicity of the design and conservation of parts by avoiding the necessity of supplying screen voltages.

A 6SF5 was also chosen instead of a gas-type tube for the relay-control tube first because once the gas tube has been ionized, it must be reset; secondly because the high-mu triode is much less critical and more stable with line-voltage fluctuations and last because there are only three types of tubes used in the complete unit, thus cutting down inventories at the station.

It will be necessary to add either a one-μf capacitor or two 0.5-μf capacitors to each capacitor which is contained in the original audio tuned circuit. This was designed to operate at about 6,000 cycles but it will operate very well at 1,000 cycles with the added capacitance. The two stages of tuned audio resonate very sharply at 1,000 cycles and feed two resistance-coupled audio stages which drive a small speaker and also supply the voltage which is rectified by the 1N34 crystal. This voltage is applied to an integrating network. At the levels commonly encountered on network lines, the capacitor will be charged to the required voltage to make the relay control tube pull the relay in after from 6 to 10 seconds.

The relay can operate a common doorbell from a separate transformer source or from the heater supply of the warning unit. It can also apply voltage to a brilliant warning light which will attract attention at the operating position. Very little can be heard from the speaker during regular programs, but it will supply plenty of audio when a 1,000-cycle tone is applied. The sensitive relay used in this particular installation is an 8,000-ohm plate relay also salvaged from the Hammarlund Fleet-Control surplus equipment. To avoid trouble, a 120-ma transformer was used, as the equipment is left running night and day and it generally pays to have a power transformer that will not overheat over long periods of time.

Different values may be chosen for the integrater to give a longer delay time before sounding the warning, if desired, and a wire-wound variable resistor may be used in the cathode of the relay control tube (about 20,000 ohms) to afford a closer control of the time element. After constructing the equipment and adjusting it with an audio oscillator, it was installed and the local telephone company called. They obligingly fed a 1,000-cycle tone at program level while the final touch-up adjustments were made.

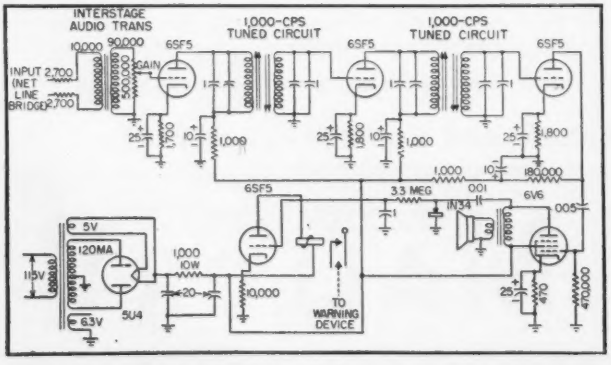


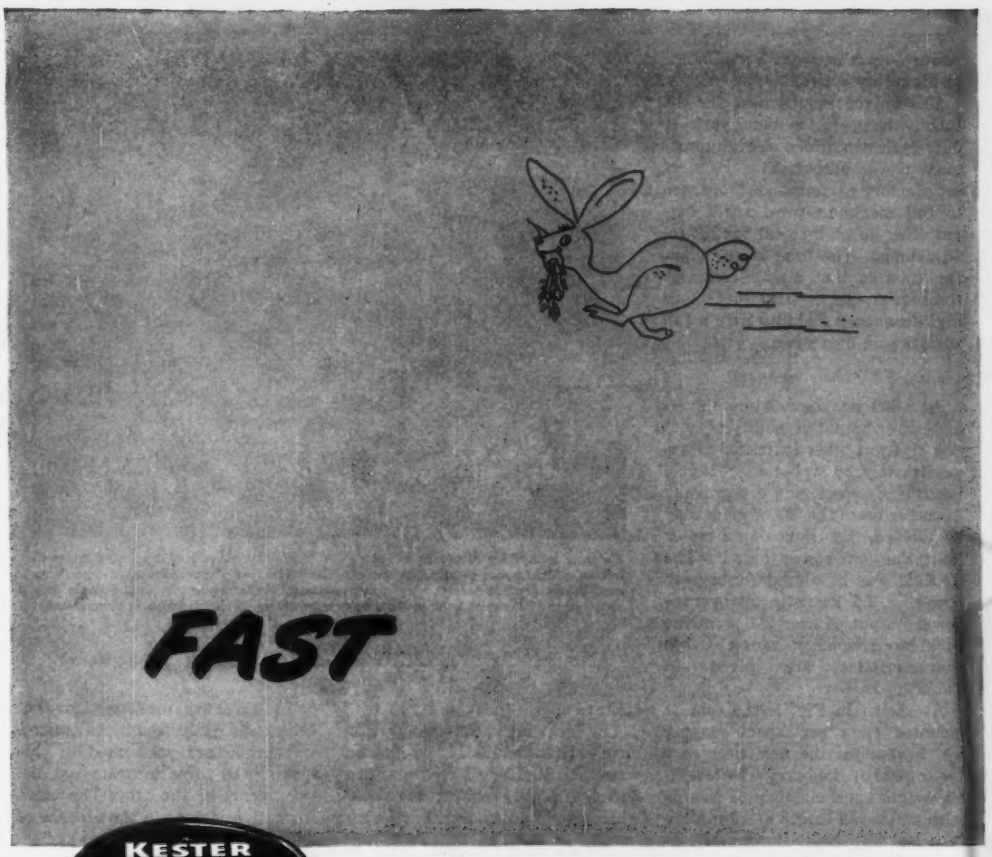
FIG. 1—Schematic of the 1,000-cycle warning device for bridging network program lines

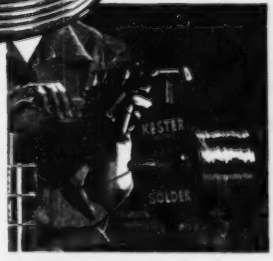
Ground-Transmitter Klystron for Air Navigation

By VINCENT LEARNED

Engineering Department Head
Electronic Tubes
Sperry Gyroscope Co.
Great Neck, N. Y.

DEVELOPMENT of a klystron tube for the responder-type of ground transmitters for air navigation systems is described. This tube is for the 9,300-mc frequency region with





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power output between 5 and 20 kw at high duty cycles.

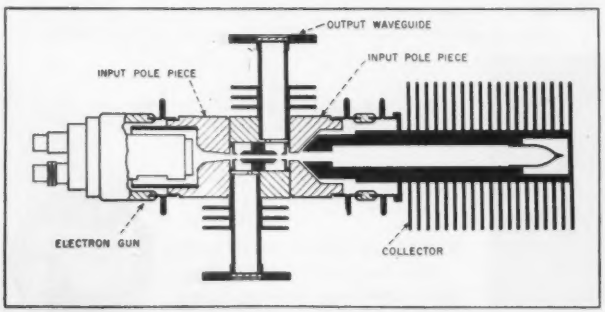
The unique requirement for the tube is the operation under variable duty-cycle conditions at high maximum power output. This requires satisfactory performance from zero to full maximum-rated-power output with no mechanical tuning readjustment. The tube is an amplifier tube so that master-oscillator techniques can be used to achieve high-frequency stability with a full variation in duty cycle.

SAX-22 Development

At 9,300 mc, the maximum average-power-output capability of gridded klystron tubes is limited to approximately 50 w because of grid heating. By employing a very small diameter beam the use of grids may be avoided, thus removing a major limitation on power output. The SAX-22 was developed for a peak power of 7.5 kw with an average power output of over 200 w in the 9,300-mc frequency range. Other characteristics are given in Table I.

As shown in Fig. 1, the tube is mounted on a permanent magnet which supplies the field necessary for control of the beam. The assembly weighs approximately 6½ pounds with an overall length of 10 in. The tube has waveguide input and output which is designed to operate into a matched ½ by 1-in. waveguide transmission line. Adequate cooling fins are provided for dissipating the large average power. A compensator is provided on the tuning mechanism to hold the cavities on frequency for a wide range of body temperature. Typical characteristics are shown in Table I.

The drawing below shows the cross-section details of the internal construction. The electron gun produces a highly convergent beam which enters an axial magnetic field through a hole in the input pole piece and traverses the input gap, the drift tube and the output gap. The input gap velocity-modulates the beam which becomes density-modulated while moving down the drift tube. The output cavity extracts the fundamental r-f components of current in the beam and delivers part of it to the useful load.



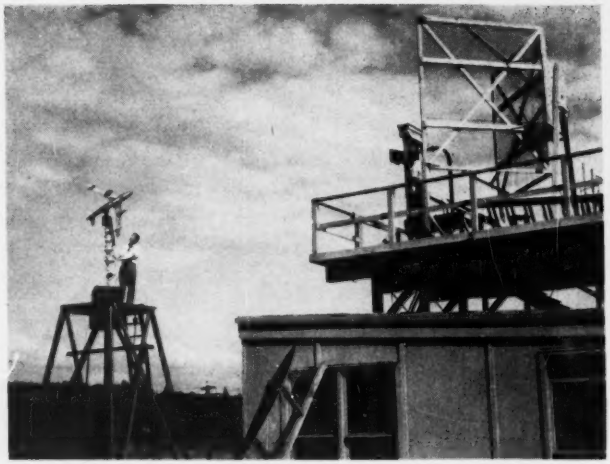
Cross-sectional view of 9,300-mc klystron

The three separate functions that have to be performed by any microwave tube are performed in this klystron by three separate and distinct parts of the tube. The beam formation is done in the absence of any r-f fields in the cathode region. The r-f interaction takes place in the central region only, where very little beam collection need occur. The third function, the collection of the spent beam, is then performed by the collector at any desired power density. This allows each section to perform its function in an optimum manner.

The cavities are coupled to the waveguides through inductive coupling irises. Flexible diaphragms mounted in the sides of the cavities provide a means of tuning. The waveguide coupling connections terminate in a flanged structure which carries a ceramic window sealed to a matching alloy frame. To keep the cavity resonators from mistuning under a variable duty cycle, the dissipation must be kept as small as possible, the internal temperature rise minimized and compensation employed for the wide range of temperatures.

(Continued on page 156)

ANTENNA TEST LABORATORY



Antenna laboratory of the Boeing Airplane Company housed at right and tower at left on which model airplane is mounted for tests. Radio waves beamed from horn atop laboratory are received by model antennas inside model airplane. Signals thus received are conveyed back to laboratory by shielded cable for strength measurement as airplane is rotated

JAN (MIL) and SUPER-JAN (MIL)

. . . JUST OFF PRESS comes this Sprague Catalog 21 with complete details on paper dielectric capacitors designed to meet Joint Army-Navy Specification JAN-C-25. Comprehensive data on sizes, characteristics, ratings, performance and other factors makes the new catalog invaluable to users of JAN paper capacitor types. Copies are available on letterhead request.

Over and beyond JAN specifications, Sprague has developed many new ways to reduce size and weight and to improve the high-temperature performance of capacitors and other electronic components. In effect, these are "Super-JAN" components—fully approved via JAN deviations to equipment manufacturers and widely used in critical military applications. At the right are four examples of units that Sprague can supply where equipment engineering progress calls for components that *exceed* JAN requirements.

SPRAGUE SUBMINIATURE PAPER CAPACITORS

Hermetically-sealed, metal-encased and far smaller than equivalent JAN styles. Available in types for 85° C. and 125° C. operation. Sprague Bulletin 213-B gives full technical data.

COMPARISON—TYPICAL SUPER-JAN VERSUS JAN UNITS
Metal-Cased Tubular Paper Capacitor, Both Leads Insulated from Case

	Sprague Type 196P47497S1	Nearest JAN-C-25 Equivalent CP25A1EC504K
Capacitance (Mfd., ± 10%)	0.47	0.50
Voltage, DCW	200	200
Insulation Resistance: at 25°C	30,000 M Ω*	6000 M Ω
at 85°C	700*	600 M Ω
at 125°C	20*	**
Capacitance Change (%) From 25°C to −55°C	−4*	−15
Operating Ambient (°C) Max.	+125*	+85
Minimum	−55	−55
Dielectric Test	Twice Rated Volts for 2 Min.	Twice Rated Volts for 1 Min.
Life Test at 85°C	250 hrs., 1.5 × rated DCWV	250 hrs., 1.5 × rated DCWV
Life Test at 125°C	250 hrs., 1.4 × rated DCWV*	**
Moisture Resistance	Hermetically Sealed	Hermetically Sealed
Length	1-9/16*	2-1/8
Diameter	9/16*	3/4
Volume (cu. in.)	0.39*	.94

* Ahead of and Beyond JAN ** Above Temperature Limit of JAN-C-25

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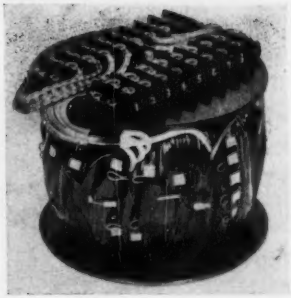
THE ELECTRON ART

Edited by JAMES D. FAHNESTOCK

Magnetic Amplifier Voltage Regulator 140
Special Tubes for Broad-Band Amplifiers 142
An Electronic Pneumotachograph 208
Radioactive Current Source 212
Transmission-Line Tubes 214
New British Tube for High-Speed Photos 218
Super-Speed Tape Puller for Computer Memory 222



Magnetic amplifier used in voltage regulator circuit

Magnetic Amplifier Voltage Regulator

MANY vacuum-tube voltage regulators have been described in the literature, with varying degrees of regulation and complexity. The following is a description of a tubeless device capable of regulating at 160 to 400 volts within 0.5 percent for load currents from 0 to 500 ma (with line voltage constant), and within 0.5 percent for ± 10-percent change in line voltage and load currents of 0 to 300 ma. This performance is available for ambient temperatures from 0 to 55 C. The regulator is virtually indestructable and its life is almost indefinite.

Figure 1 shows a cross section view of the magnetic amplifier designed specifically for this application. The amplifier was found to have an average power gain of the order of 10^6 with a load resistance of 10 ohms at a power level of 0.5 to 360 watts. Figure 2 shows the transfer characteristic curves for the magnetic amplifier used.

In Fig. 3 is shown the complete circuit diagram of the regulator, with power transformer and bridge rectifier. The error detector and reference quantity are incorporated in a single parallel circuit (enclosed in dashed lines), containing a linear resistance in series with one d-c control coil (1,000 turns) and a nonlinear resistance composed of six thyrites in parallel, in series with a second oppositely-connected d-c control coil (5,000 turns). At approximately 140 volts across this network, the two control coils are contributing approximately the same ampere turns, but in opposite senses. The resultant is that required for the optimum quiescent operating point. If the output voltage rises, the ampere turns in the control coil with the nonlinear resistance (W_n) rise very fast, while the ampere turns in the linear resistance winding (W_1) rise linearly. The result is a negative increase (decrease) in total d-c ampere turns. Hence the reactance of the a-c winding in the primary circuit of the power transformer increases, the primary voltage is decreased, and the output voltage returns to the desired value. A drop in output voltage will have the opposite effect.

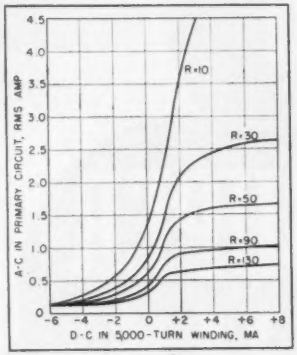


FIG. 2—Transfer characteristic of magnetic amplifier

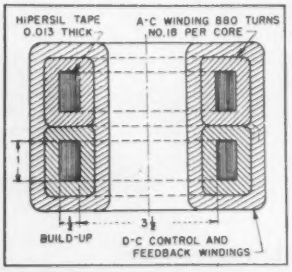


FIG. 1—Construction of magnetic amplifier used in voltage regulator

Different values of output voltage may be obtained by adjusting R_1. The value of this control is simply set to make up the difference between the output voltage and the operating point of the nonlinear device which, in this case, is 140 volts.

A third control winding (100 turns) in series with the load is so oriented on the magnetic amplifier that changes in load current cause changes in primary voltage to the transformer for further regulation.

Figure 4 shows the remarkable regulating performance obtained with the magnetic amplifier supply. Regulation data taken on the three units constructed were found to

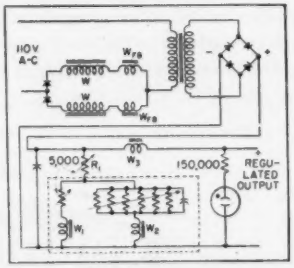


FIG. 3—Circuit diagram of magnetic amplifier voltage regulator

SIGNAL GENERATOR
FOR OMNI-RANGE RECEIVERS

Type 211-A • Frequency Range 88-140 Megacycles

Output Frequency Crystal Monitored
Amplitude Modulation 0-100%
Modulation Fidelity ±0.5 db
30 cycles to 11 kilocycles
Negligible Spurious FM

The Type 211-A Signal Generator is specifically designed for the testing and calibrating of omni-range radio receiving equipment. It is also well suited for laboratory and development work where a precision type amplitude modulated R. F. signal source is required.

Careful consideration has been given to the location of panel controls with respect to function and degree of use. The main frequency dial is located in the center of the panel, with the vernier dial to the left in close proximity, utilizing the same fiducial for simplicity and ease of operation. Symmetrically located to the right of the frequency dial is the output attenuator dial, directly calibrated in microvolts. The center panel enclosure embodies those controls which the operator will have the greatest occasion to use, permitting rapid, accurate settings to be made with maximum convenience.

The calibration accuracy of the frequency dial settings is ±0.25% at any point; however since crystal controlled frequencies are also available within the instrument, zero beats may be obtained from which the output frequency may be standardized to an accuracy of about ±0.025% by slipping the vernier frequency dial with respect to the main frequency dial. This feature permits the identification and checking of channel frequencies differing by as little as 100 kc.

Write today for complete details!

SPECIFICATIONS

FREQUENCY RANGE: Master Oscillator: 88-140 megacycles in one range. Vernier frequency dial has 100 divisions and is coupled to the main tuning capacitor through a 120:1 gear drive. Each vernier division is equivalent to a 10 kc. change in frequency.

Crystal Controlled Frequencies: Either of two crystals 110.100 mc. and 114.900 mc., accurate to ±0.0035%, may be selected by a switch for use individually or in combination with the master oscillator to standardize its output frequency.

AMPLITUDE MODULATION CHARACTERISTICS: Two amplitude modulation ranges, 0-30% and 0-100%, are provided for use with the internal oscillator or a low distortion external oscillator. Distortion is 5% or less at 95% amplitude modulation.

Internal Audio Oscillator: Two modulating frequencies, 400 and 1000 cycles.

Modulation Amplifier: The internal modulating amplifier has the following characteristics:

Uniform response within ±0.5 db. 30 cycles to 11 kc.
Uniform response within ±0.1 db. 90 cycles to 150 cycles.
Uniform response within ±0.1 db. 9500 cycles to 10.5 kc.

Phase Distortion: (up to 60% amplitude modulation.)

Less than 0.25 degrees at 30 cycles.
Less than 10 degrees at 11 kc.

AUDIO TEST VOLTAGE: This instrument contains a demodulator or detector which supplies to front panel terminals a portion of the demodulated carrier.

SPURIOUS FM: Less than 1 kc. at 60% AM.

OUTPUT ATTENUATOR: Single ended piston type, adjustable from 0.2 volt to 0.1 microvolt. Output impedance as seen looking in at terminals of output cable is 26.5 ohms.

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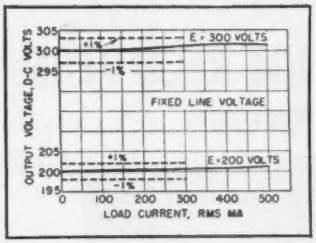
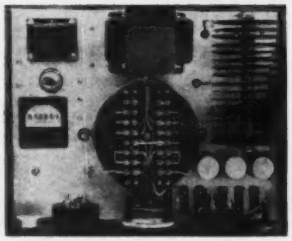


FIG. 4—Constant-line-voltage curves show regulation of output for varying output current values



Complete magnetic amplifier chassis includes necessary transformers, fuses, rectifiers, capacitors, meters and controls

coincide within a small fraction of a percent over the entire range of line voltage (0 to 135 volts) and load current (0 to 500 ma) covered.

This article is based on the United States Atomic Energy Commission report AECD-2851 entitled, "Magnetic Amplifier Voltage Regulator" by John L. Wolff, Jr., of the Westinghouse Electric Corporation, Atomic Power Division, Pittsburgh, Pennsylvania.

Five Million Million Million Mile DX

RADIO WAVES emanating from the great nebula in Andromeda have been measured successfully at Manchester University Physical Laboratories, Jodrell Bank Experimental Station, Cheshire, England. Using the equipment shown in the accompanying photographs, British scientists have succeeded in detecting the minute amounts of r-f power (of the order of micro-micro-micro-microwatts) that left these stars more than 750,000 years ago.

These radio stars do not coincide with any of the bright visual stars and cannot therefore be viewed with an ordinary telescope, however powerful.

Inside view shows screen where signals from outer space are displayed

Special Tubes For Broad-Band Amplifiers

IMPROVED broad-band amplifier performance can be derived through the use of a line of special tubes recently developed for the Bell System. These tubes have higher ratios of transconductance to capacitance, brought about mainly by a new grid employing many turns of very fine wire. Gain-bandwidth products about twice that of the 6AK5 have been obtained, with transconductance values up to 45,000 micromhos.

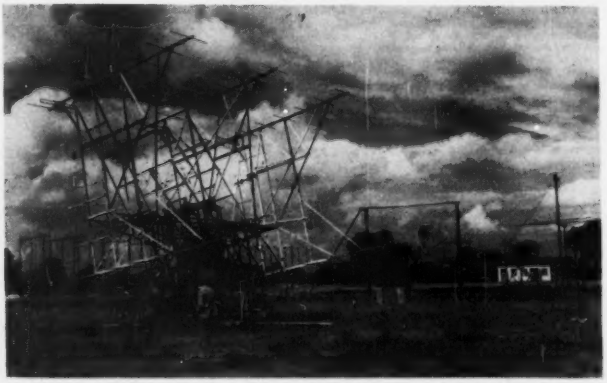
The feedback amplifiers in which these tubes are used will transmit an 8-mc band, which can be used for 1,800 telephone channels or 600 telephone channels and one television channel.

The remarkable features of this line of tubes are obtained by reducing spacings to the limit of mounting ability. The present state of the art permits a spacing of 0.0025 inch. To keep shunt capacitance low, wire size is reduced to the limit set by wire manufacturing facilities. Tungsten is used for its high tensile strength. Figure 1 gives a graphic comparison of spacing and wire-size dimensions employed.

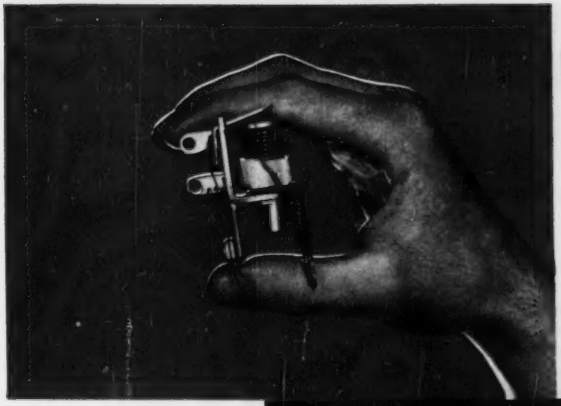
In fabricating the grid structures, special techniques are used. Because of the small size of the grid wires, a rigid frame must be used, as shown in Fig. 2. It is necessary to have the wires straight and tight so the grid will present a flat uniform control surface to the cathode.

(continued on page 204)

Receiving antenna on 120-ft tilted pole is positioned at focus of 220-ft parabolic reflector made of fine wires



British version of moon radar is built on World War II searchlight base. Smaller type is shown at right, while in background may be seen meteor radar antennas. Location is Jodrell Bank Experimental Station, Cheshire, England

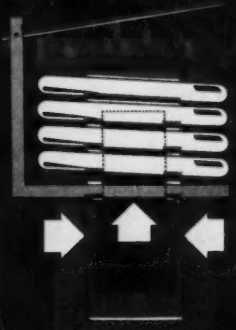


new *Silic-O-Netic* TIME DELAY RELAY

LOOK at the qualifications the new SILIC-O-NETIC Time Delay Relay has for your requirements. Even with its small size, it's a load carrier in itself . . . in most cases eliminating the need for an auxiliary relay. The time element which is hermetically sealed has only one moving part . . . forever free of dirt, dust and moisture.

SMALL SIZE
LOW COST
ABSOLUTE DEPENDABILITY

The SILIC-O-NETIC Time Delay Relay employs silicones . . . operates dependably on a hydraulic-magnetic principle regardless of position or frequency of operation. This relay is available with timings up to four minutes. It has a service life measured in many millions of operations . . . yet Heinemann high production techniques make it available to you at LOW COST.



COMPLETE DATA and graphic illustrations of the SILIC-O-NETIC operating principle; forms, models and timings available are included in Bulletin 5001.

A copy will gladly be sent to you upon request.

HEINEMANN

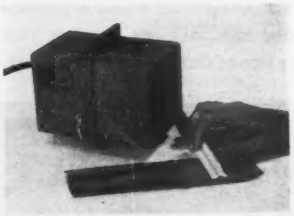
ELECTRIC COMPANY

97 Plum Street
Trenton 2, N. J.

NEW PRODUCTS

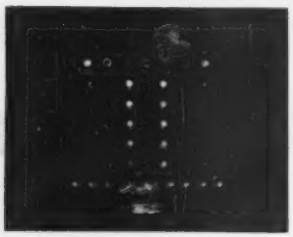
Edited by WILLIAM P. O'BRIEN

Lab and Industrial Apparatus Production Continues High . . . Miniaturization of Components Maintains Pace . . . Thirty-Four Manufacturers' Catalogs Are Discussed



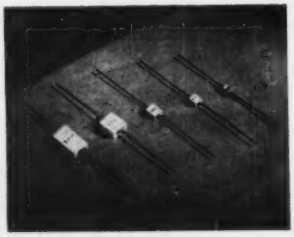
Pocket Oscillograph

CONSOLIDATED ENGINEERING CORP., 300 N. Sierra Madre Villa, Pasadena 8, Calif. Up to nine sources of data representing vibration, pressure, velocity, strain or other phenomena, either static or dynamic, can record simultaneously on the new 5 × 5 × 8-in. recording oscillograph, type 5-118. Operating from a 28-v d-c power source, the compact instrument is ideally suited to mobile testing programs where space and weight saving are important. Developed originally for a missile-testing program, the midget oscillograph produces dynamic test records 3½ in. wide and up to 40 ft long on which the nine separate phenomena can be measured with respect both to time and to each other.



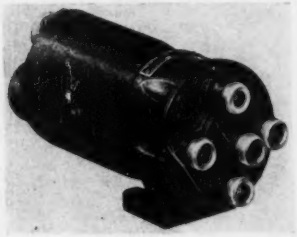
Scanning System

MINNEAPOLIS-HONEYWELL REGULATOR CO., Brown Instruments Div., Wayne & Windrim Ave., Philadelphia 44, Pa., has developed an electronic scanning system designed to automatically and continuously monitor up to 270 separate processing temperature points. The system, which records only temperatures deviating beyond a preset limit, includes an audible alarm that permits immediate correction of excess temperatures, and replaces the cost and use of several instruments and time-taking logging operations and maintenance. It is especially applicable for steam generating stations and in the manufacture of synthetic fibers and yarns where the temperature of feed material supplying spinerettes must be maintained at specific levels to eliminate costly defects in the product. Illustrated is the control unit.



Tiny Capacitor

VITRAMON, INC., Stepney, Conn., has added a new style capacitor to its series. The unit, shown on the right in the photograph, has an overall length of 0.4 in. and a maximum cross-section dimension of 0.2 in. being equivalent in size to a JAN CC20 capacitor. Designated as type 49, it is available up to 51 μμf at 500 volts d-c working and to 110 μμf at 250 volts. Included in the photograph are also the company's four stock sizes of capacitors which are supplied with ±5 percent or ±0.25 μμf tolerance from 0.5 μμf through 1,000 μμf. Operating temperatures of all are −55 C through 200 C.

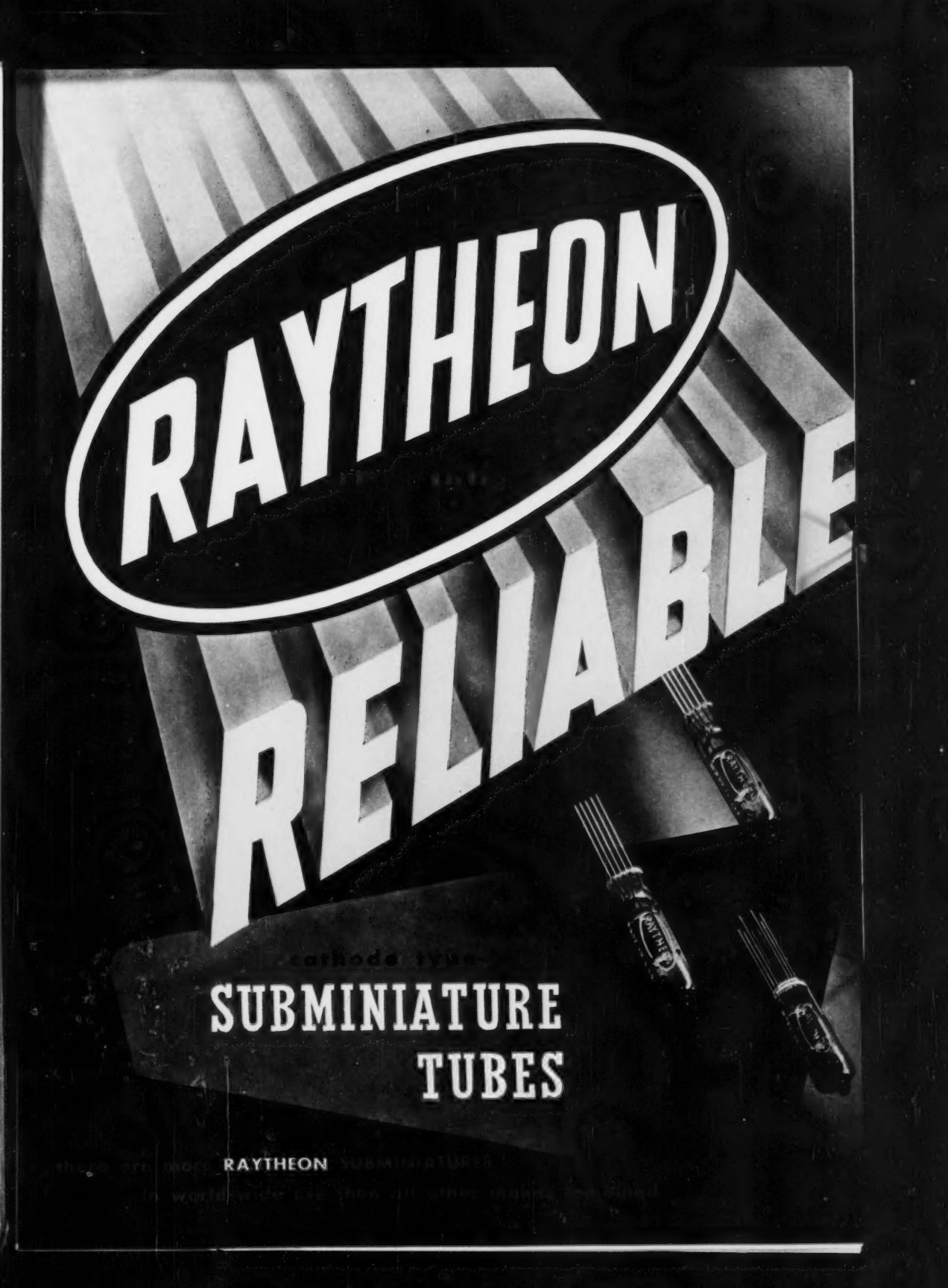


Coaxial R-F Switch

TRANSCO PRODUCTS, INC., 12210 Nebraska Ave., Los Angeles, Calif. A new compact single-pole, 4-position coaxial r-f switch for applications at radar frequencies, has a frequency range up to 11,000 mc and vswr of less than 1.5 to 1. Insertion loss is less than 0.5 db throughout operating range, and attenuation between unused connectors is 50 db minimum. Power handling capabilities are equal to improved type N connectors. Motor-driven actuator rating is 24 to 28 v d-c. Various models are available for aircraft applications.

Acoustical Lens

JAMES B. LANSING SOUND, INC., Los Angeles, Calif., is producing model 175DLH full acoustical lens for loudspeaker use which distributes a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CK6148
R. F. Pentode
$E_f = 6.3V.$ $I_f = 200$ mA.
Noise output 50 mV. max.
$E_b = 200$ V. max.
$E_{c2} = 150$ V. max.

CK6149
Medium Mu Triode
$E_f = 6.3V.$ $I_f = 200$ mA
Noise output 25 mV. max.
$E_b = 275$ V. max.

CK6150
R. F. Pentode—Mixer
$E_f = 6.3V.$ $I_f = 200$ mA
Noise output 100 mV. max.
$E_b = 200$ V. max.
$E_{c2} = 155$ V. max.

CK6151
High Mu Triode
$E_f = 6.3V.$ $I_f = 200$ mA
Noise output 25 mV. max.
$E_b = 275$ V. max.

CK6152
Low Mu Triode
$E_f = 6.3V.$ $I_f = 200$ mA
Noise output 25 mV. max.
$E_b = 250$ V. max.

These new Raytheon Reliable Subminiature tubes resulting from five years of continuous production of their prototypes are designed to meet the stringent requirements of vital military equipments. In addition to the rigid ratings for shock, fatigue, centrifugal acceleration, 5000 hour life, and heater cycle life, particular attention has been paid in the design and manufacture of these tubes to permit 200°C ambient temperature operation and lower noise output ratings as indicated under each type.

Write Today! For complete mechanical and electrical data on these new RAYTHEON types, ask for the new Raytheon RELIABLE Subminiature Tube Catalog E.

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VARGLAS SILICONE is efficient under a wide temperature range . . . to 500° F. or more in some applications, yet remains completely flexible at —85° F. It has excellent resistance to moisture; is flame resistant and self-extinguishing.

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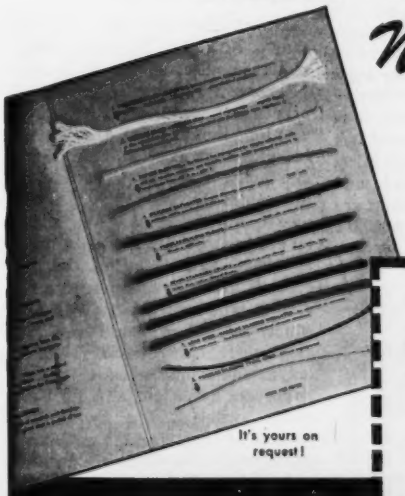
2. **NORMALIZING** — Removes binder and organic inclusions from the Fiberglas — improves electrical qualities and allows uniform impregnation.
3. **SILICONE HIGH TEMPERATURE RESIN** — Which has a natural affinity for the Fiberglas, renders it abrasion-resistant, flexible and non-fraying.

VARFLEX CORPORATION, manufacturers of electrical insulating tubing and sleeving, are insulation specialists. If you require special insulation, write us about your problems. We will gladly quote on your individual requirements or NEMA specifications. We have a complete line of sleeving and tubing, based on Fiberglas, cotton, and extruded plastics.



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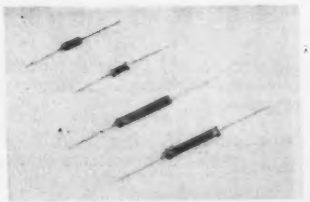
uniform sound wave over the entire audio spectrum. It smoothes out the high frequencies and gives them a mellowness unlike the multicellular horn that performs well at some frequencies but beams or distributes poorly at others. The new lens is not sensitive to frequency because the bandwidth is wider than the audio spectrum with which it is used.

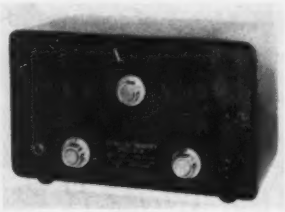


Deposited Carbon Resistors

PHAOSTRON CO., 151 Pasadena Ave., South Pasadena, Calif. The Carbohm, a deposited carbon resistor, is suitable for high-frequency applications, particularly where high resistance is needed, or power dissipations up to 2 w are required. The resistors are also applicable to electronic equipment that is subject to extremes of temperature. Carbohms come hermetically sealed in glass or in humidity-impervious casing. They are available with a threaded stud or tapped hole terminal, as well as the axial lead pictured.

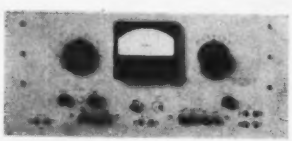
Cavity Resonators

MOTOROLA INC., 4545 W. Augusta Blvd., Chicago 51, Ill., has developed a precision selector cavity resonator designed to eliminate radio and tv interference caused by spurious and harmonic radiations of base station 2-way radio transmitter equipment. The cavities, intended for the 30-48 mc, 72-76 mc, 122-132 mc and 132-180 mc communications band are temperature compensated for optimum performance over wide temperature ranges. Mechanical design and element dimensions are proportioned for optimum impedance match and a low vswr. Each unit has an input and output impedance of 50-72 ohms with a 250-watt maximum power rating.



ULF Oscillator

KROHN-HITE INSTRUMENT CO., 580 Massachusetts Ave., Cambridge, Mass., announces model 400-A ulf oscillator that simultaneously provides both sine and square-wave voltages at any frequency between 0.009 and 1,100 cps. An R-C bridge sine-wave oscillator circuit is employed with special circuitry to eliminate tuning and switching transients. Other features are low hum and distortion, excellent amplitude constancy over the entire frequency range, a single scale logarithmic dial with a vernier tuning control and low input power. It is especially useful for design and test of servomechanisms, geophysical and seismological instruments and feedback amplifiers. Dimensions are 12 × 7 × 8 in. and price is $350.00.



Gain Set

THE DAVEN CO., 191 Central Ave., Newark, N. J., has available the type 12A transmission measuring or gain set, an a-c operated, rack-mounted instrument designed for the measurement of voice transmission systems. Source output and receive input are 600-ohm balanced circuits, provided with d-c blocking capacitors so that the equipment will not interfere with the normal operation of modern dial systems. The oscillator consists of a 1,000-cycle low distortion feedback type R-C oscillator, buffer and associated power amplifier. The output level is + 10 to − 35 db adjustable in 1-db steps. The receive section consists of a high-gain, wide-range amplifier whose range is variable from + 20 to − 60 db, full scale meter reading, in steps of 10 db.

Step-Motor Counter

GENERAL ELECTRIC CO., Schenectady 5, N. Y., has developed a step-motor impulse counter to provide 100-percent accuracy up to 60 counts per sec. Designed to cover counting ranges above those possible with electromechanical counters and below those in which scalers are normally required, the device has a counting range which makes it especially useful in high-speed production counting. The unit consists of a step motor with a resetting type register, and a power supply enclosed in a steel case. The step motor and register assembly are mounted on the power supply enclosure, which contains an electronic switch and a h-v supply capable of supplying the power requirements of a phototube preamplifier. Overall dimensions of the

(Continued on page 226)

audiodiscs* For more than 12 years, Audiodiscs have consistently set the standards for the finest professional performance in instantaneous and master disc recording. Their flawless perfection, wide-range frequency response, extremely low surface noise at all diameters and complete freedom from humidity effects are just a few of the reasons why Audiodiscs are first choice with professional recordists from coast to coast. They know from long experience that they can depend on Audio for the *consistent, uniform quality* that is so essential in modern sound recording work.

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NEWS OF THE INDUSTRY

Edited by WILLIAM P. O'BRIEN

Low-Power CAA Omniranges Tested

THE CAA is experimenting with two low-power omniranges—the TVOR and the LVOR. The former uses a 50-w transmitter rather than the 200-w transmitter of the standard VOR and operates without customary standby equipment. It is a relatively low-cost omnirange for terminal use where an instrument landing system is not economically justified. It will permit approaches to airports under the same minimum ceilings and low visibility conditions as low-frequency aids now used.

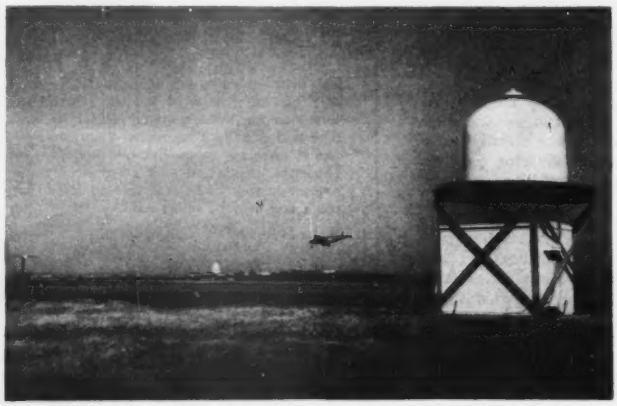
One TVOR has been installed at the Oklahoma City Airport and another is in the process of being tested at the National Airport in Washington. The one at Oklahoma has the antenna situated on a counterpoise 12 feet in diameter placed on top of the transmitter building. This building is 8 feet square; the standard VOR building is about 16 by 28 feet. The receiver in the aircraft is the same for the standard and the baby omni. A primary function of the standard VOR is to furnish enroute navigation aids; an auxiliary function is furnishing of approach guidance to the airport. The second function requires a special location. The baby omni makes this second function its primary one. It can also be used as a gap filler in the enroute navigational system. The TVOR is now being tested for use in connection with departure procedures and radar vectoring.

The LVOR, the other low-power omnirange, has a 50-w transmitter and also standby transmitting equipment. It is housed in the same type building as the standard VOR. One such facility is being installed at the airport in Toledo, Ohio.

Both baby omniranges are in the experimental stages, although LVOR is not so far advanced as TVOR. Whether or not it is advisable to go into a big LVOR program has not been decided. The CAA has no desire to become involved in complicated frequency allocations problems, and such a program might lead to this.

The components in TVOR and LVOR are substantially the same. All test facilities utilize a new type antenna that provides an improved cone over the station. This antenna can be used on all VOR's and other facilities. It narrows the cone from 90 deg to about 20 deg.

The cost of the TVOR runs about $35,000, the LVOR about $78,000, and the VOR, $93,000. This is the complete facility including structural cost, engineering equipment and installation. It does not, however, include distance measuring equipment. When available, DME will be installed at VOR and LVOR at an additional $22,000 cost.



Baby VOR (vhf omnirange) in experimental use at National Airport, Washington, D. C., for approach guidance. Monitor antenna is at left

TV Freeze Study Group Named

A DOUBLE-BARRELED study by members of the television industry to determine the effect on the national economy and the mobilization program of the lifting or continuing of the tv freeze on station construction was recently announced by the RTMA. Dr. W. R. G. Baker, chairman of the RTMA Television Committee, named a task force to study and report on the effect on materials and manpower if the freeze is lifted and the effect on the tv industry if construction of additional stations is not permitted.

Members of the task force are: William H. Chaffee of Philco Corp., chairman; Keeton Arnett of Allen B. DuMont Laboratories Inc.; Edwin D. Foster of RCA and C. W. Michaels of General Electric Co.

Reliability Group Set Up by RDB

A CLEARING house has been set up recently in the Research and Development Board of the Department of Defense to collect and disseminate information on reliability of electronic equipment.

This information, furnished to laboratories engaged in government work, is expected to result in more reliable performance of electronic equipment with a minimum of maintenance.

For example, a contractor with security clearance, who is doing government business with laboratories, can receive the RDB information by requesting it from the Service with which he is dealing. Assume X is working on a guided missile contract and he is having trouble with reliability of his electronic equipment. He can go to the Service where he has his contract and request further technical information. The Service in turn will

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get it from the new clearing house. The Research and Development Board does not distribute material directly to the contractor.

M. Barry Carlton of the RDB secretariat, and Albert F. Murray, radio and television consultant to RDB, have been named Coordinators of Reliability and will head the group. Members include representatives of the Munitions Board, the Office of the Joint Chiefs of Staff, the Army, Navy and Air Force as well as RDB.

According to RDB officials, improvement in reliability must include the following steps which lead eventually to use of equipment in the field: military characteristics, experimental models, specifications, manufacturing control procedures, service tests, final inspection, packaging and shipping, storage, installation, operational use and maintenance.

New Awards

JOHN H. NELSON, radiowave analyst of RCA Communications, Inc., who last April disclosed evidence of direct relationship between magnetic storms on earth and the position of planes in the solar system, recently received the first merit award of the Foundation for the Study of Cycles. The award, in recognition of Nelson's "notable service in the radio propagation field," was presented by George Baekeland, chairman of the committee of the Foundation and vice-president of the Bakelite Corp.

Another first of its kind is the David Sarnoff Gold Medal Award, presented to Otto H. Schade of the RCA Tube Department, for outstanding technical achievements in the field of television and motion pictures. The medal was presented by the Society of Motion Picture and Television Engineers at a luncheon opening the society's 70th semiannual convention at the Hollywood-Roosevelt Hotel recently.

Engineer Training Program

A TRAINING program aimed at meeting ever-growing needs for engineers with experience in all phases of electronic tube manufacturing is under way at major plants of the General Electric Company's Tube Department. The two-part program is meant to provide, first, a pool of engineers with a broad knowledge of tube manufacturing from which the department can draw men for engineering and supervisory positions, and second, a group of creative engineers who can help GE push forward with a program of mechanization of tube production.

Fifteen young engineers have already been picked for rotating assignments in GE tube plants in Schenectady, Syracuse and Buffalo, N. Y., and Owensboro, Ky. Trainees will be selected primarily from graduates of GE's test engineering program and from the ranks of engineering school graduates who are recommended for their special maturity and ability. All will start with a short indoctrination period in factory engineering, followed by about six months of actual shop experience.

Upon completion of the course those selected for general supervisory training will then be given assignments as functional working leaders and foremen in several fields for from one to two years.

Trainees picked as equipment development specialists will receive further assignments in tool design, methods-planning and specific equipment projects, working with the Electronics Division's Equipment Development Works in Schenectady, N. Y.

MEETINGS

JAN. 7-8: AIEE Conference on Electronic Instrumentation in Nucleonics and Medicine, Hotel Statler, New York, N. Y.

JAN. 21-25: AIEE Winter General Meeting, Hotel Statler, New York, N. Y.

MARCH 3-6: 1952 IRE National Convention, Waldorf-Astoria Hotel and Grand Central Palace, New York, N. Y.

MARCH 31-APRIL 4: Thirtieth Annual NARTB Convention, Stevens Hotel, Chicago, Ill.

MAY 16-17: Fourth Southwestern IRE Conference and Radio Engineering Show, Rice Hotel, Houston, Texas.

JUNE 23-27: AIEE Summer General Meeting, Hotel Nicollet, Minneapolis, Minn.

AUG. 27-29: Eighth Annual Pacific Electronic Exhibit, Municipal Auditorium, Long Beach, Calif.

SEPT. 8-12: National Instrument Conference and Exhibit, Hotel Cleveland, Cleveland, Ohio.

OCT. 27-29: 1952 Radio Fall Meeting, sponsored by IRE and RTMA, Hotel Syracuse, Syracuse, N. Y.

Electronic Flight Simulator Announced

FUTURE F-86D Sabre jet pilots will "shoot down" their first enemy planes without actually seeing the enemy or even leaving the ground. It's all a matter of electronics in the latest device for pre-combat training of Air Force fighter pilots.

This latest step in pilot training was revealed with successful completion of tests of the F-86D Sabre flight simulator at the Engineering and Research Corp., Riverdale, Maryland, plant, where the new earthbound trainer was designed and built under contract from North American Aviation, Inc., designer and manufacturer of the swept-wing Sabres.

Named the Sabre Flightronic by ERCO, it is the first fighter all-weather simulator delivered to the Air Force. Its delivery also marks the first time that a simulator has been put into training use concurrently with the beginning of quantity production of a new plane.

The new simulator, a 35,000-pound package of metal, wiring, electronic tubes, radar scopes and servomechanisms, is also the first to combine the simulation of two planes—the one being flown and

(Continued on page 286)

For Engineers...

YOUR CAREER OPPORTUNITY of A LIFETIME...at RCA-NOW!

IF YOU ARE FACING a big question: "What is the best move I can make to further my career?"—we believe you will find the answer on this page.

Today, as never before, RCA is engaged in far-reaching electronic developments that have created a need for career men of talent. This means you have the chance of a lifetime to make a permanent connection with RCA in a position offering you the opportunity of a successful career in the field of your choice. Here is what RCA offers.

Wide Choice of Projects

Unusual opportunities await qualified ELECTRONIC, ELECTRICAL and MECHANICAL ENGINEERS . . . PHYSICISTS . . . METALLURGISTS . . . PHYSICAL CHEMISTS . . . GLASS TECHNOLOGISTS—in research, development, design and application, also in technical sales. Qualified engineers have the opportunity to choose the area of activity they like best.

POSITIONS OPEN IN THE FOLLOWING FIELDS:

TELEVISION DEVELOPMENT— Receivers, Transmitters and Studio Equipment

ELECTRON TUBE DEVELOPMENT— Receiving, Transmitting, Cathode-Ray, Phototubes and Magnetrons

TRANSFORMER and COIL DESIGN

COMMUNICATIONS— Microwave, Mobile Aviation, Specialized Military Systems

RADAR— Circuitry, Antenna Design, Computer, Servo-Systems, Information Display Systems

COMPUTER DEVELOPMENT and DESIGN Digital and Analog Computers, Magnetic Recording, Pulse Circuitry, Storage Components, Systems Design

NAVIGATIONAL AIDS

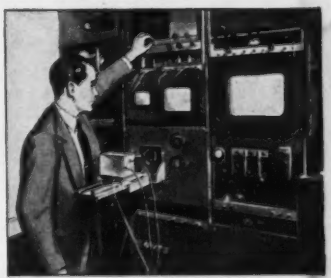
TECHNICAL SALES

ELECTRONIC EQUIPMENT FIELD SERVICE

If you qualify for any of the positions listed above, write us for a personal interview—include a complete resumé of your education and experience. Write to:

Mr. Robert E. McQuiston, Specialized Employment Division, Dept. 46A. Radio Corporation of America, 30 Rockefeller Plaza, New York 20, N. Y.

Professional Status. RCA engineers enjoy the highest professional recognition among their colleagues. You work in close collaboration with scientists and engineers who are distinguished in the industry. You receive recognition for your accomplishments.



Laboratory Facilities. At RCA, unexcelled laboratory resources and advanced technical apparatus are available. You have unlimited opportunities for the complete expression of your talents in the fields of electronics.

Good Living Conditions. You have a choice of residential locations offering suburban-convenience or quiet, countryside living. Good shopping facilities, schools, churches, medical services and modern hospitals are close by. Excellent opportunities for graduate study.

Position Security. These are not temporary positions. Activities are focused not only on the long-range national defense program, but also on a diversified line of products for commercial use. You and your family are protected by Company-paid hospital, surgical, accident, sickness, and life insurance. A modern retirement program helps provide for your future.

Rapid Advancement. Opportunities at RCA are exceptional, for you to move ahead in the career of your choice. You can advance to high-level and supervisory positions which are filled from RCA's engineering staff. Salaries, determined on the experience and ability of individual applicants, are reviewed at regular intervals for increases on a merit basis.

RADIO CORPORATION of AMERICA

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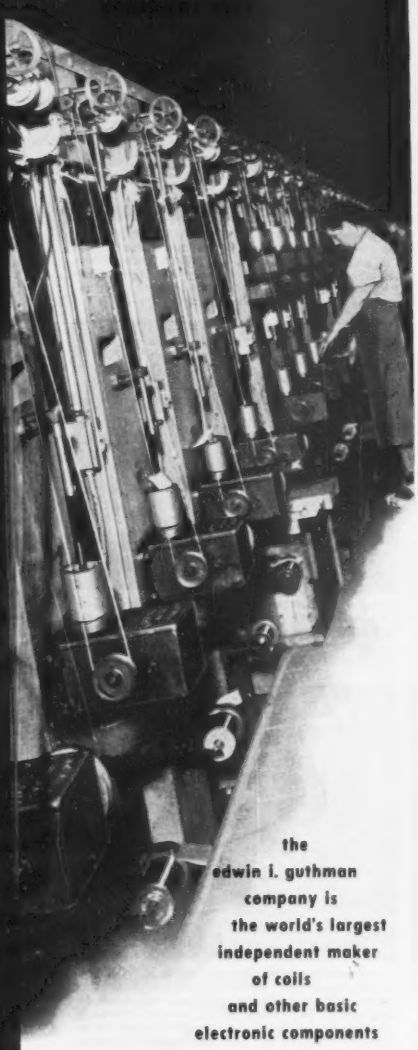

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NEW BOOKS

Time Bases

BY O. S. PUCKLE. *John Wiley & Sons, Inc., New York,* 1951, *Second Edition,* 387 *pages,* $5.00.

IN ESSENCE this book is the same as the first edition with an attempt to bring to light the newer developments in time bases and some of their more diversified uses such as counting and frequency division. To this end a wealth of material has been added, including a new chapter on Miller time bases and a considerable enlargement on linearization of the trace and push-pull deflection.

Many sundry circuits and tabulations that cannot be conveniently worked into the main body of the book make up the appendices. Among the most useful information is a technique outlined under "Aids to Rapid Determination of the Shaping Effects of a Network" in which it is shown that almost all useful waveforms can be broken down into a series of step functions of either amplitude or velocity.

This book was well thought out and equally well edited with a minimum of errors, the most outstanding being the loose use of the words "blocking oscillator" which seems to be used wherever a transformer is used as an integral part of a time base generator.

In dealing with the actual production of time bases, the book is quite complete from the earliest neon time base down to more modern Miller capacitance time bases with their many embodiments. With

(Continued on page 302)

RELEASED THIS MONTH

An Introduction to Acoustics: R. H. Randall; Addison-Wesley Press; $6.00.

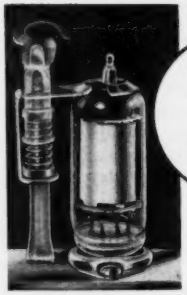
Basic Electrotechnics: B. L. Goodlet; Longmans, Green and Co.; $4.00.

Broadcast Operator's Handbook: H. E. Ennes; John F. Rider Publisher; 2nd edition; $5.40.

Materials Technology for Electron Tubes: W. H. Kohl; Reinhold; $10.00.

BIRTCHER
TUBE CLAMPS
Hold Tubes in Sockets under all Vibration, Impact and Climatic Conditions

83 VARIATIONS FOR STANDARD TUBES



NEW CLAMP FOR MINIATURE TUBES

You can't shake, pull or rotate a tube out of place when it's secured by a Birtcher Tube Clamp. The tube is there to stay. Made of Stainless Steel, the Birtcher Tube Clamp is impervious to wear and weather.

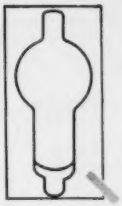
BIRTCHER TUBE CLAMPS can be used in the most confined spaces of any compact electronic device. Added stray capacity is kept at a minimum. Weight of tube clamp is negligible.

Millions of Birtcher Tube Clamps are in use in all parts of the world. They're recommended for all types of tubes: glass or metal—chassis or sub-chassis mounted.

THERE'S A BIRTCHER TUBE CLAMP FOR EVERY STANDARD AND MINIATURE TUBE!

Write for samples, catalogue and price lists.

THE BIRTCHER CORPORATION
4371 Valley Blvd.
Los Angeles 32, Calif.



New rider

for a fast, familiar track

SINCE 1945, DPi has been supplying manufacturers of television picture tubes with inline exhaust systems. Even with the largest tubes, this fast-production race track has been giving the high vacuum that means sharper-focus beams, longer, more reliable life.

For the first time, DPi offers to makers of large power tubes, high-frequency oscillators, and x-ray tubes this system converted to their use. With the same trouble-free efficiency, capable of producing ultimate vacuums below 1 x 10^{-6} mm Hg, and affording the same fast production pace, it will evacuate your tubes on a continuous instead of a batch basis. And the system is adaptable to running a variety of tubes at once.

If you already have a DPi inline system and would like to consider conversion, or are interested in a new system, talk it over with our engineers. We're ready to help you meet your problem, whether it involves a single unit or the design of a complete exhaust system for a tube factory. Just write ***Distillation Products Industries***, Vacuum Equipment Department, 727 Ridge Road West, Rochester 3, N. Y. (Division of Eastman Kodak Company).

high vacuum research and engineering

Also . . . vitamins A and E . . . distilled monoglycerides . . . more than 3500 Eastman Organic Chemicals for science and industry

TYPE BH6A
RANGE: 1.4 - 75.0 mc
Supplied per Mil type CR-10; CR-19; CR-23; CR-27; CR-28; CR-32; CR-33; CR-35; CR-36 when specified.

It's Knowledge

A finished crystal unit, by Bliley, typifies the accumulated know-how of 21 years experience. This includes craftsmanship and engineering, methods and techniques, production and quality.

Such **knowledge** is gained only from actual experience. It's basic with Bliley, and, your assurance of complete satisfaction.

TYPE AR2W RANGE: 0.800 - 0.10000 mc Supplied per Mil type CR-15; CR-16; CR-29; CR-30 when specified.

TYPE MC8 RANGE: 1.0-10.0 mc Supplied per Mil type CR-5; CR-6; CR-8; CR-18 when specified.

TYPE SR5A
RANGE: 2.0-15.0 mc
Supplied per Mil type CR-1A when specified.

TYPE TCO-1 Temperature Control Oven.

Bliley CRYSTALS

BLILEY ELECTRIC COMPANY
UNION STATION BUILDING
ERIE, PENNSYLVANIA

Backtalk

This department is operated as an open forum where our readers may discuss problems of the electronics industry or comment upon articles which ELECTRONICS has published.

More Information

DEAR SIRS:

HAVING noted the unfortunate experience of the Mount Wilson and Palomar Observatories as described by Mr. William A. Baum in "Backtalk" (October, 1951, p 154), I would like to point out that some steps have already been taken to provide more complete information on electronic parts to designers of equipment.

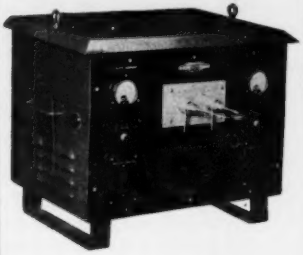
For the past several months, a program has been sponsored by the Navy Bureau of Ships at Southwest Research Institute to produce a parts index which will contain detailed design and performance features of miniature electronic parts. The Bureau and the Institute recognized that this publication will expedite the choice of suitable parts, thereby reducing the amount of valuable engineering time now wasted in this phase of equipment design.

The aim is to produce an index which is as useful as tube handbooks are presently—with all data shown in standard forms, frequent revisions as necessary, and eventually complete information on capacitors, resistors, small motors, transformers, batteries, etc. The original scope of the program was outlined in a microfilm catalog of miniature parts prepared by the Bureau.

The index is also intended to serve as a guide in the establishment of procurement specifications or the extension of existing ones, since it will indicate actually achievable performance. The program can be most successful if continued cooperation is received from

(Continued on page 311)

2 KW VACUUM TUBE BOMBARDER OR INDUCTION HEATING UNIT



For Only $650.

Never before a value like this new 2-KW bench model "Bombarder" or high frequency induction heater . . . for saving time and money in surface hardening, brazing, soldering, annealing and many other heat treating operations.

Simple . . . Easy to Operate . . . Economical Standardization of Unit Makes This New Low Price Possible.

This compact induction heater saves space, yet performs with high efficiency. Operates from 220-volt line. Complete with foot switch and one heating coil made to customer's requirements. Send samples of work wanted. We will advise time cycle required for your particular job. Cost, complete, only $650. Immediate delivery from stock.

Scientific Electric Electronic Heaters are made in the following ranges of Power: 1-2-3½-5-7½-10-12½-15-18-25-40-60-80-100-250KW.

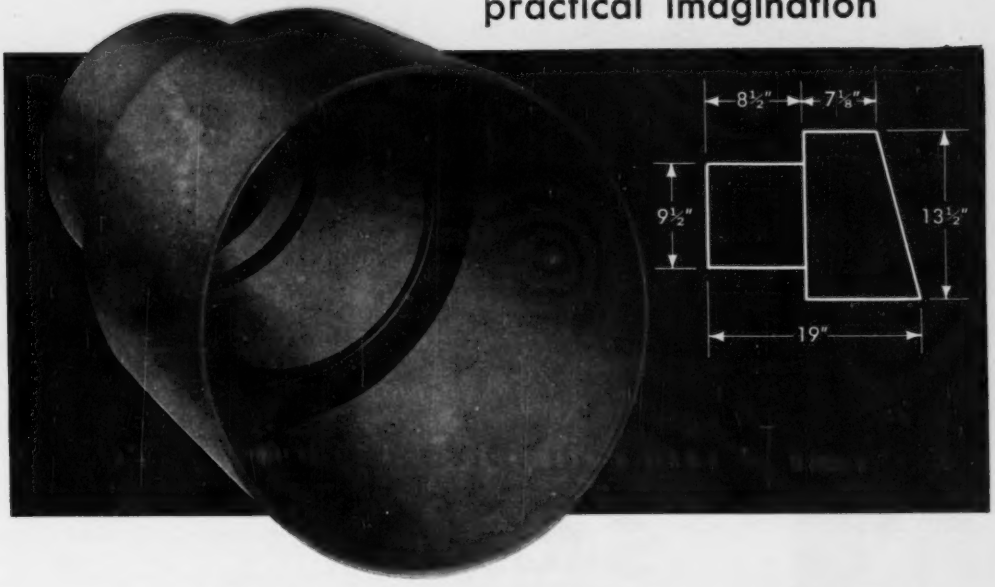
Scientific Electric

Division of

"S" CORRUGATED QUENCHED GAP CO.

107 Monroe St., Garfield, N. J.

practical imagination



"welded" assembly makes large plastic parts practical and economical

Look at this large, laminated plastic part. It is 19" long with two concentric diameters of 13½" and 9½" connected by a flat ring. Think of the cost of molds for making such a piece—and then consider the fact that only a few such parts are required. The cost would be prohibitive.

It is on problems like this that Continental-Diamond's knowledge of plastics and their fabrication pays off for you. C-D engineers took two Dilecto tubes of the required diameters and wall thicknesses and then cut a ring from a sheet of Dilecto to just fit the O.D. of the smaller tube and the I.D. of the larger.

These three parts were then literally "welded" together into a strong, low cost part. The material used to do the "welding" is one of the compounds developed by C-D in their vast experience of fabricating parts of Fibre, Vulcoid, Celoron, Micabond, Dilecto and combinations of all of them.

If you have a problem—or a standard application for plastics, it will pay you to check with your nearest C-D office.

your partner in producing better products

DILECTO (Laminated Thermosetting Plastic)
CELORON (Molded High-Strength Plastic)
DIAMOND FIBRE (Vulcanized Fibre)
VULCOID (Resin Impregnated Fibre)
MICABOND (Bonded Mica Splittings)

DE-S-51

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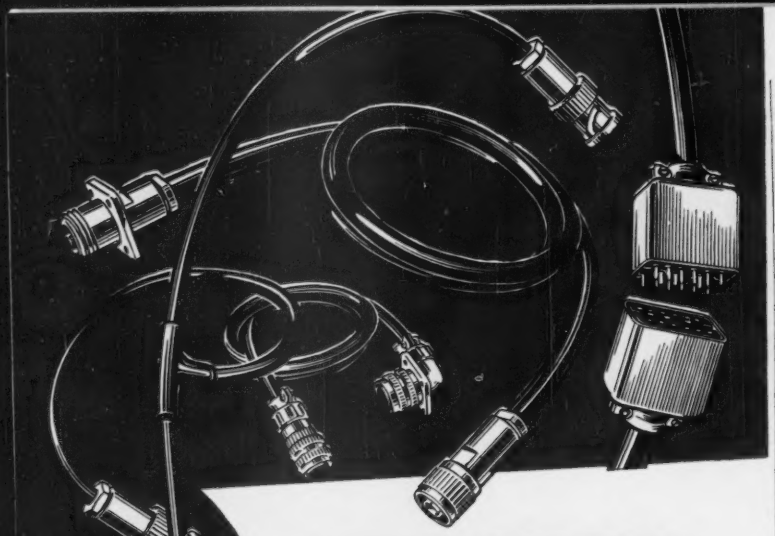
Continental-Diamond FIBRE COMPANY

Established 1895 Manufacturers of Laminated Plastics since 1911 NEWARK, DELAWARE



PREPAREDNESS PRODUCTION Enlists AMPHENOL

CABLE HARNESSES produced by Amphenol are assembled with the same care and rigid inspection that characterizes *all* components manufactured by Amphenol. Electrical inspection includes insulation resistance, continuity and high voltage breakdown tests. All assemblies meet and are superior to the rigid Army-Navy specifications. Specifying Amphenol complete cable assemblies cuts costs, saves valuable man hours and insures against losses due to errors and rejects.

AN CONNECTORS supplied by Amphenol insure lowest millivolt drop, extra high tensile strength, polarized shells and simple assembly. Amphenol non-rotating contact solder pockets mean faster soldering and more positive contact. Amphenol has the widest selection of AN Connectors to meet current standard MIL-C-5015 shell styles and applications.

POWER PLUGS represent a new approach to the requirements of the Signal Corps for waterproof connectors. They take up very little space and provide quick connect and dis-connect under the most adverse handling conditions.

100 CONTACT CONNECTORS for all applications where a large number of circuits must be broken quickly and easily. These connectors feature dependability and long life as well as accurate alignment of the connections and positive contact.

AMERICAN PHENOLIC CORPORATION
1830 SOUTH 54TH AVENUE • CHICAGO 50, ILLINOIS

NOW AVAILABLE: *Catalog B-2—A General Catalog of Amphenol Components—will be sent on request.*

AMPHENOL

TUBES AT WORK

(continued from page 138)

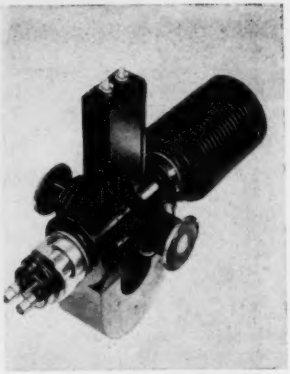


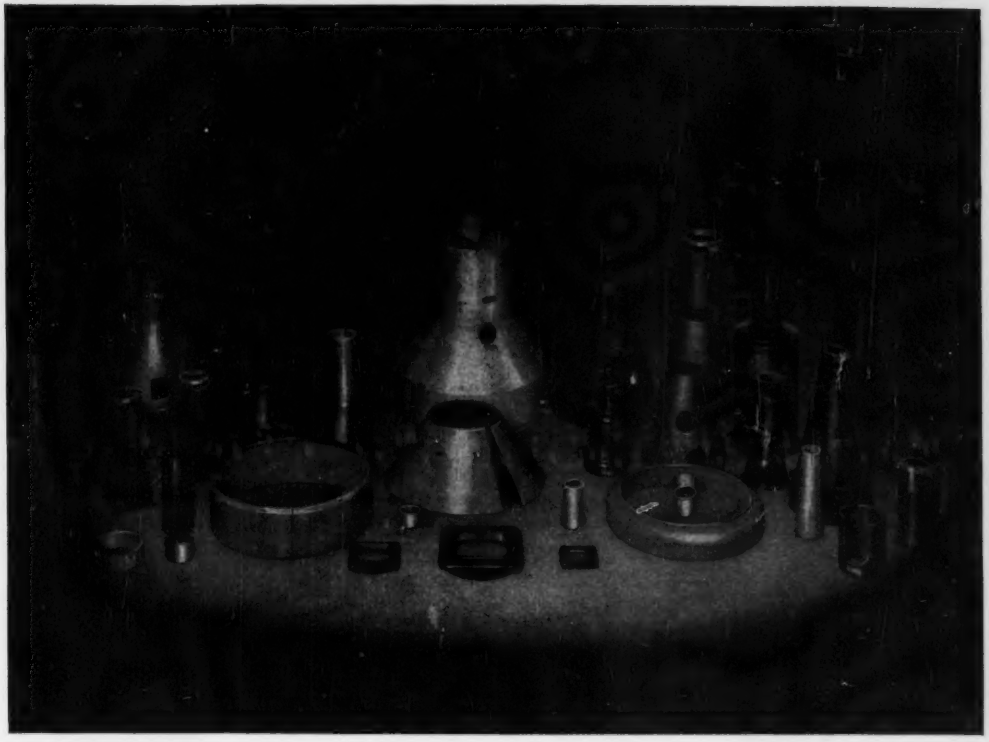
FIG. 1—SAX-22 pulse-amplifier klystron for 9,300 mc. A permanent magnet is used to focus the beam

A highly convergent beam is formed by electrostatic focusing. The beam shape follows a convergent path determined by space-charge repulsion and, in the absence of any ion focusing or magnetic field, the beam approaches a minimum diameter and then would diverge again due to space-charge repulsion. In this tube the beam converges to a minimum diameter in the normal manner but at this point enters a uniform axial magnetic field. The field produces a radial force tending to cause the beam to converge. If the magnitude of the magnetic field and the original direction of the electron motion are correct, the convergent force can be made to balance exactly the space charge forces tending to cause the beam to diverge. Under these conditions, a parallel beam entering an axial magnetic field can be maintained parallel for any desired length.

By use of this combination of electrostatic beam formation and magnetic beam control, a high beam

Table I—Typical Characteristics of SAX-22

Output power (peak)	7.5 kw
Drive power (peak)	300 w
Frequency	9,310 mc ± 30 mc
Beam voltage (peak)	17 kv
Beam current (peak)	2.5 amp
Duty cycle (max)	2.5 percent
Pulse length (max)	5 μsec
Bandwidth (optimum drive)	40 mc



Designed for Application

Mu Metal Shields

The James Millen Mfg. Co. Inc. has for many years specialized in the production of magnetic metal cathode ray tube shields for the entire electronics industry, supplying magnetic metal shields to manufacturing companies, laboratories and research organizations. Stock shields are immediately available for all of the more popular sizes and types of cathode ray tubes as well as bezels for 2", 3" and 5" size tubes.

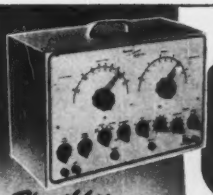
Many production problems, however, make desirable special shields designed in conjunction with the specialized requirement of the basic apparatus. Herewith, are illustrated a number of such custom built shields. Our custom design and fabrication department is at the service of our customers for the development and manufacture of magnetic metal shields of either nicoloi or mumetal for such specialized applications.

JAMES MILLEN MFG. CO., INC.

MAIN OFFICE AND FACTORY

MALDEN, MASSACHUSETTS, U.S.A.

New 1952 HEATHKITS



Heathkit TELEVISION GEN. KIT $39.50

Heathkit ELECTRONIC SWITCH KIT $19.50

Heathkit AUDIO GEN. KIT $34.50

Heathkit CONDENSER CHECKER KIT $19.50

Heathkit R. F. SIGNAL GEN. KIT $19.50

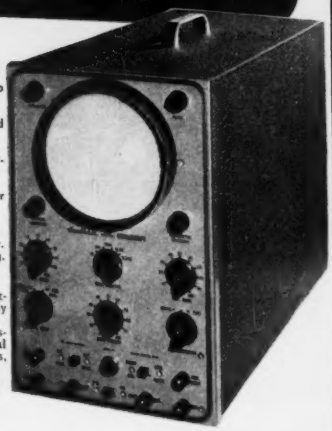
Heathkit A.C. VOLTMETER KIT $29.50

Heathkit SQUARE WAVE GEN. KIT $29.50

Heathkit INTERMODULATION ANALYZER KIT $39.50

Heathkit AUDIO FREQ. METER KIT $34.50

Heathkit 5" OSCILLOSCOPE KIT



- New "spot shape" control for spot adjustment — to give really sharp focusing.
- A total of ten tubes including CR tube and five miniatures.
- Cascaded vertical amplifiers followed by phase splitter and balanced push-pull deflection amplifiers.
- Greatly reduced retrace time.
- Step attenuated — frequency compensated — cathode follower vertical input.
- Low impedance vertical gain control for minimum distortion.
- New mounting of phase splitter and deflection amplifier tubes near CR tube base.
- Greatly simplified wiring layout.
- Increased frequency response — useful to 5 MC.
- Tremendous sensitivity .03 RMS per inch Vertical .6V RMS per inch Hor.
- Dual control in-vernier sweep frequency circuit — smoother acting.
- Positive or negative peak internal synchronization.
- Multivibrator type Wide Range Sweep Generator.

A brand new 1952 Heathkit Oscilloscope Kit with a multitude of outstanding features and really excellent performance. A scope you'll truly like and certainly want to own.

The kit is complete with all parts including all tubes, power transformer, punched and formed chassis, etc. Detailed instruction manual makes assembly simple and clear — contains step-by-step instructions, pictorials, diagrams, schematic, circuit description and uses of scope. A truly outstanding value.

MODEL O-7
SHIPPING WT. 24 LBS.

$43.50

Heathkit VACUUM TUBE VOLTMETER KIT

- New styling — formd case for beauty.
- New truly compact size — Cabinet 4⅛" deep x 4-1/16" wide x 7⅜" high.
- Quality Simpson 200 microamp meter.
- New ohms battery holding clamp and spring clip — assurance of good electrical contact.
- Highest quality precision resistors in multiplier circuit.
- Calibrates on both AC and DC for maximum accuracy.
- Terrific coverage — Reads from ½V to 1000V AC, ½V to 1000V DC, and .1 to over 1 billion ohms resistance.
- Large, clearly marked meter scales indicate ohms, AC Volts, DC Volts, and DB — has zero set mark for FM alignment.
- New styling presents attractive and professional appearance.

The 1952 Model Heathkit Vacuum Tube Voltmeter! Newly designed cabinet combines style and beauty with compactness. Greatly reduced size to occupy a minimum of space on your work-bench. Covers a tremendous range of measurements and is easy to use. Uses only quality components including 1% precision resistors in multiplier circuit for greatest accuracy. Simpson 200 microamp meter with easy to read scales for fast and sure readings.

All parts come right with kit, and complete instruction manual makes assembly a cinch.

MODEL V-5
SHIPPING WT. 5 LBS.

$24.50

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ROCKE INTERNATIONAL CORP
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The HEATH COMPANY

BENTON HARBOR 10, MICH.

New CBS-HYTRON 12B4

New 9-pin miniature; high-perveance, low-mu triode with 6/12-volt heater for parallel or series connection. 12B4 is designed specifically for vertical amplifiers with limited primary B supply voltages. Delivers adequate vertical sweep power in proper circuit to sweep any 70° rectangular picture tube.

Characteristics of 12B4 are similar to those of 6W6GT, but 12B4 . . . for same input . . . supplies substantially more sweep power. 12B4, because of special design and processing, is also virtually free from grid emission.

New CBS-HYTRON 12BY7

New 9-pin miniature; very-high-transconductance pentode amplifier. As video amplifier in high-quality receivers, gives extended gray scale. In low-cost receivers, 12BY7 provides adequate voltage amplification for wide-band video amplifiers with primary B voltages as low as 135 volts.

Within its power capabilities, 12BY7 gives gains equal to those of 6AG7. High ratio of transconductance to interelectrode capacitances makes 12BY7 useful as video i-f or pulse amplifier for radar. High grid-to-screen transconductance suits 12BY7 (within its power handling capabilities) for class C harmonic oscillators.

Which of these CBS-HYTRON ORIGINALS can you use?

New CBS-HYTRON 5Y3WGT

New "ruggedized," full-wave filamentary-type rectifier with electrical characteristics equivalent to those of 5Y3GT . . . but 5Y3WGT is specially designed for equipment subject to high impact and shock.

New CBS-HYTRON 12A4

New high-perveance, medium-mu, 9-pin miniature triode for use as vertical amplifier, class C oscillator, or low-distortion audio output amplifier in push pull.

New CBS-HYTRON 12BZ7

New high-mu, 9-pin miniature dual triode for high-gain audio amplifiers, gating circuits, synch separators and amplifiers.

Write for Complete Data Today

CBS HYTRON RADIO TUBES

HYTRON

A DIVISION OF COLUMBIA BROADCASTING SYSTEM, INC.

MAIN OFFICE: SALEM, MASSACHUSETTS

HYTRON RADIO & ELECTRONICS CO.
Salem, Massachusetts

Please rush me full specifications for the new CBS-Hytron types I have checked:

12B4 ..... 12BY7 ..... 5Y3WGT .....

12A4 ..... 12BZ7 .....

Name .....
(please print)

Street .....

City and State .....

when you need a

SIE

SPECIFICATIONS

Range: 1 cps to 120,000 cps

Calibration: within 1 ½% plus 1/10 cycle

Output circuits: 20 volts or 20 milliamps and 1 volt at 300 ohms constant impedance

Amplitude stability: Plus or minus ½ db

UNDESIRED VOLTAGES

Power Supply Noise: Less than 1 100% of output signal

Power Line Surge: Less than 1/10% of output signal

Harmonic Distortion: Less than 2 10% from 20 cps to 15,000 cps. Less than 1% at all other frequencies

Microphonic Noise: Less than 1/100% of output signal

SOUTHWESTERN INDUSTRIAL ELECTRONICS CO.

2831 POST OAK ROAD
HOUSTON 19, TEXAS

434 SEVENTH AVE. EAST — CALGARY, ALBERTA, CANADA

density may be obtained without requiring excessive cathode-current density. In the SAX-22, the beam density is 68 amp per square cm, whereas effective magnification reduces the cathode-current density to 1.7 amp per square cm. The requirement for a high-density small-diameter beam stems from the use of gridless interaction gaps. To obtain satisfactory coupling between the electron beam and the resonators at these frequencies, the gap necessarily is small in size. The high peak power and high duty-cycle requirements for this tube make the use of grid coupling impossible, hence the use of a gridless gap eliminates the power density consideration if the beam is properly controlled and body interception is kept small.

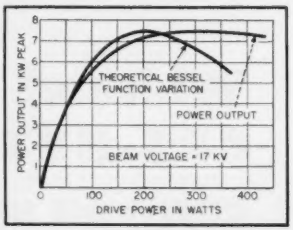

FIG. 2—Output power as a function of r-f drive power

Figure 2 shows the optimum r-f drive power to be about 300 watts. The curve is so flat that a two-to-one variation will affect the output power by only five percent. The small signal gain is about 20 db at drive powers up to 5 or 10 watts and decreases to about 14 db at maximum power output. This gives the characteristics of a linear amplifier at low level.

In Fig. 3 the power output of the SAX-22 varies approximately as the third power of beam voltage. This is a consequence of the three-halves power law for beam current in a space-charge-limited electron gun. The efficiency of the tube increases slowly with voltage, which is due to tighter coupling and relatively smaller circuit losses at the higher voltages.

It is possible, through the addition of another interaction gap and

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Every pound of idle non-ferrous metal you have is needed to help the non-ferrous smelting and refining industry keep production up to rising demand.

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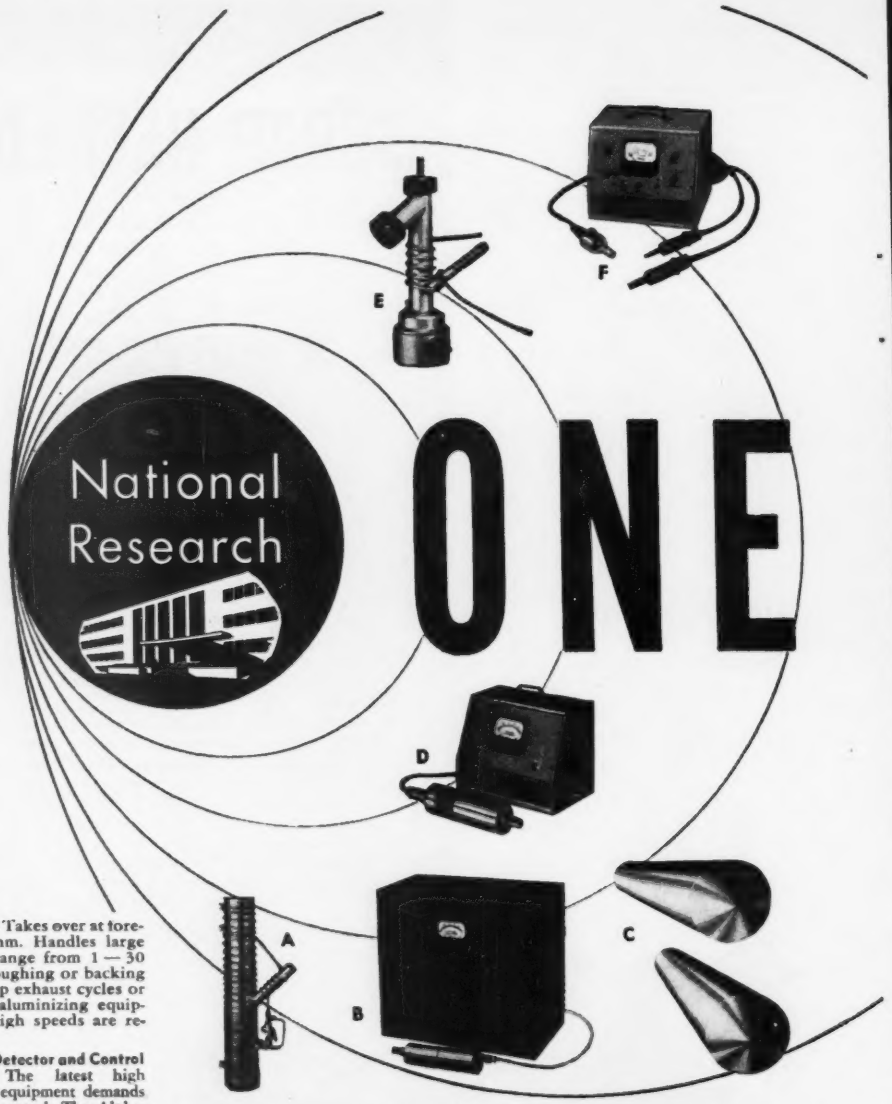

(A) B-4 Booster Pump. Takes over at forepressures up to 1 mm. Handles large amounts of gas in range from 1 — 30 microns. Ideal for roughing or backing manifolds to speed up exhaust cycles or as prime pump on aluminizing equipment or wherever high speeds are required.

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(E) B-1 Booster Pump. Specially designed for rotary exhaust units in miniature and subminiature tube production.

(F) Type 710 Thermocouple-Ionization Gauge Control. One control with two thermocouple gauges (1 — 1000 microns) and one ionization gauge (10^{-3} mm. to 10^{-8} mm. Hg range). Automatic input regulation and protective circuit.

(G) Type 701 Thermocouple Gauge Control. A light, portable instrument for vacuum testing in range 1 — 1000 microns — compact and rugged.

(H) H-4-P Purifying Diffusion Pump. Similar to H-2-P but with speeds of over 300 liters/sec from 10^{-3} to 10^{-5} mm. Hg range.

(I) H-2-P Purifying Diffusion Pump. Over 50 liters/sec in 10^{-3} mm. to 10^{-6} mm. range. Operates against forepressures as high as 0.300 mm. Blank-off 2 x 10^{-7} mm. Hg. For exhausting cathode ray tubes and magnetrons, and aluminizing operations on automatic equipment.

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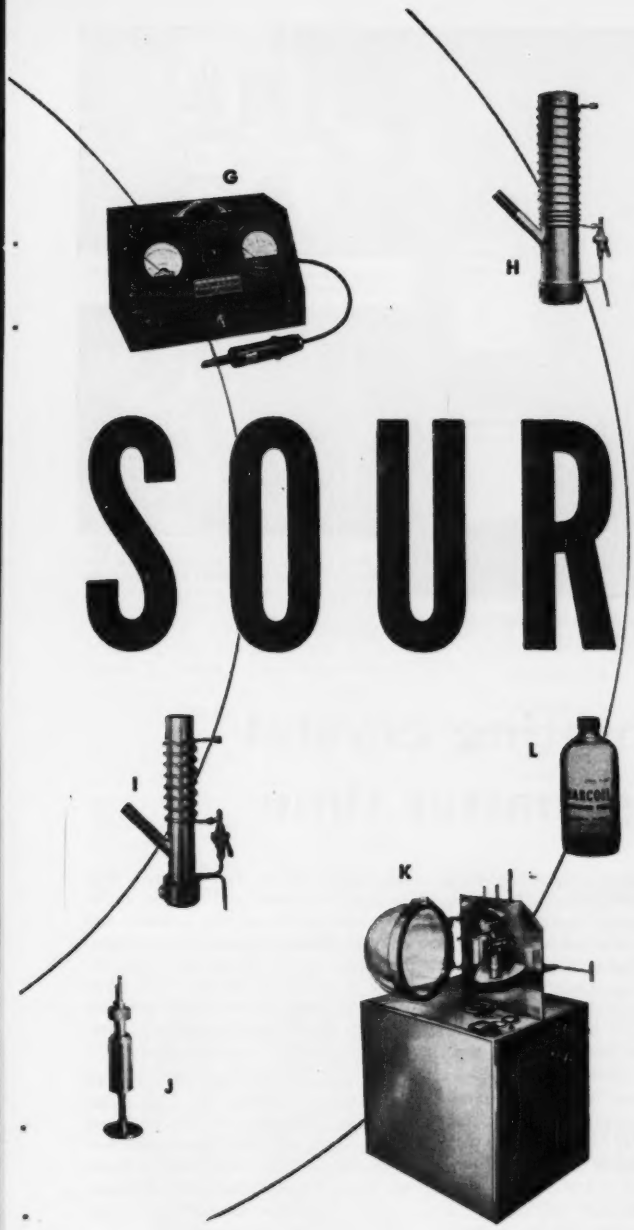
(K) Standard Vacuum Furnace. A versatile packaged unit for many metallurgical operations under high vacuum or inert atmospheres. Temperatures to 2000° C. Useful for degassing tube parts, production of germanium crystals, research and production of improved metals for tube parts, as well as general high vacuum metallurgical research work.



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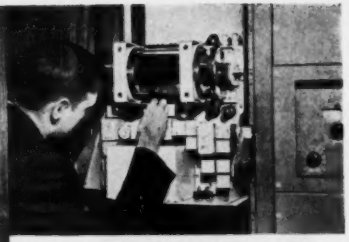
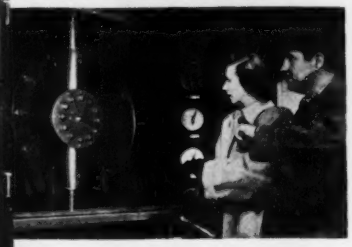


Each crystal is enclosed in a cylindrical oven which holds the crystal temperature to within 1/100 of a degree.



At the A. T. & T. building at 195 Broadway, New York, passersby set watches by the world's most accurate public clock, which is controlled by the master standard.

Front of the new frequency-time standard at Bell Telephone Laboratories. In the rear there are 600 electron tubes and 25,000 soldered connections. Room temperature is maintained within two degrees.

The controlling quartz crystal vibrates in vacuum at 100,000 cycles per second. The standard is powered by storage batteries, with steam turbo-generator standing by, just in case of emergency.

A vibrating crystal keeps master time

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The new standard also provides an independent reference for time measurements made by the U. S. Naval Observatory and the National Bureau of Standards. Thus, world science benefits from a Laboratories development originally aimed at producing more and better telephone service.

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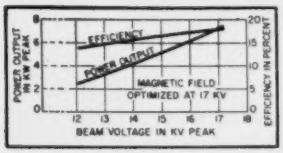
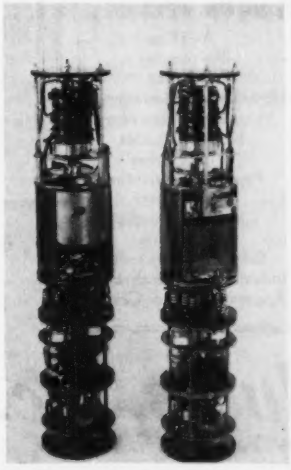


FIG. 3—Power output and efficiency versus beam voltage

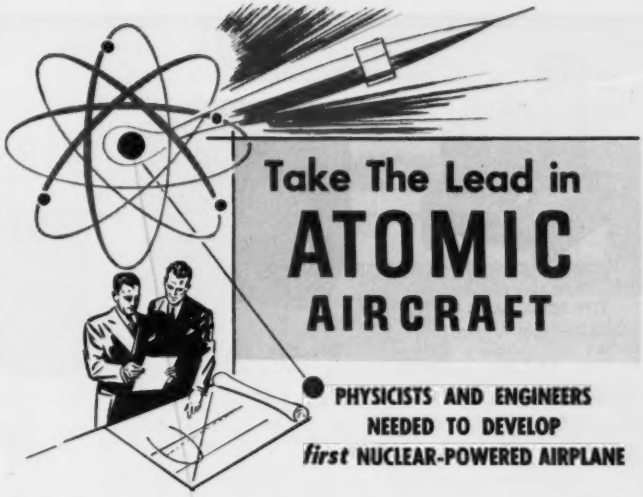
cavity along the beam, to increase the gain of the tube greatly. Other tube developments indicate that it should be possible to obtain 7.5 kw output with 3 to 5 watts drive power. Klystron frequency multipliers and a pulse amplifier are available for driving the SAX-22 at the 300-watt-drive power level.

Submerged Repeaters for Telegraph Cables

A NEW REPEATER, designed for transoceanic cable use, has been designed by the Western Union Telegraph Company. The first permanent installation was made recently in the 1 HM-BR cable, extending from Hammel, Rockaway Beach, New York, to Bay Roberts, Newfoundland. This repeater is located more than 100 nautical miles from Hammel in a depth of about 250 fathoms. Before installation of the repeater, the cable operated at a maximum speed of 83 wpm. It



Two views of the repeater switch. The switch is sealed in a steel cylinder



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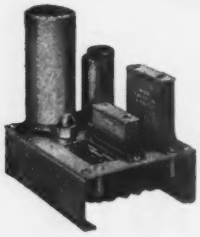

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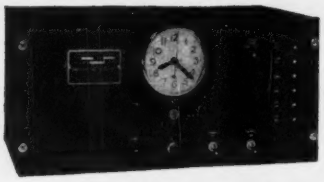
Consists of Type 2001-2 and booster to provide 10 watts at 110V at precision frequencies from 50 to 500 cycles at input power frequencies of 50 to 500 cycles, 45 watts.



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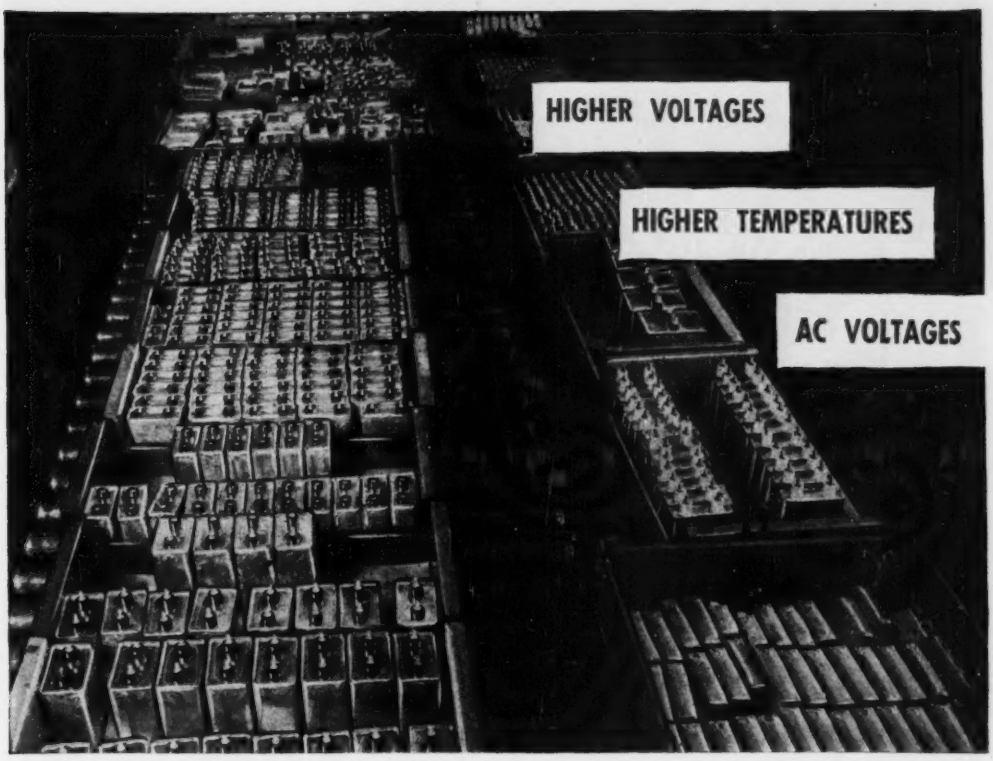

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General Electric has similar data for most of its JAN units, showing how each may be operated under a variety of conditions. For information on how these standard G-E capacitors may be applied in your circuits, consult your Apparatus Sales Office, or write to Specialty Capacitor Sales, General Electric Company, Hudson Falls, N.Y.

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407-307

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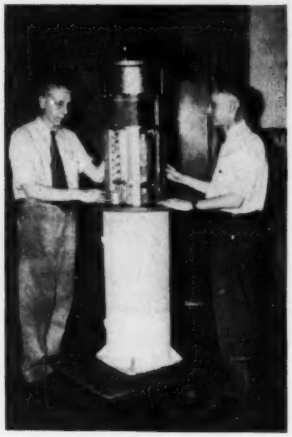
is expected now that a speed of 250 wpm will be obtained.

The repeater is made up of a 3-stage push-pull R-C coupled amplifier with input and output transformers. Preceding the transformer is a simple tuned signal-shaping network. All stages use Western Electric type 310-A tubes. Two tubes are connected in parallel and operated as triodes in each side of the output stages. Theoretical output undistorted is 0.25 watt. The output transformer circuit reduces the net output to a little less than 0.25 watt.



Lowering the repeater chassis into its case

Included in the repeater is a switch used to disconnect the repeater and join the cable through for operation without repeater or for cable testing purposes and to disconnect the regular amplifier in the event of failure and connect the spare amplifier. Two complete amplifiers are included in the repeater.

It is planned to install repeaters in depths of 200 to 1,200 fathoms or more or at hydrostatic pressures up to 3,000 psi. To withstand the large pressures, the repeater is filled with oil and a pressure equalizer automatically adjusts the internal pressure to the external pressure within a few psi. The most important element of the equalizer is a flexible, corrosion-resistant metal

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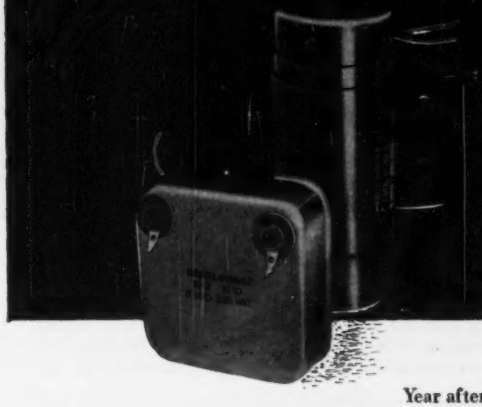

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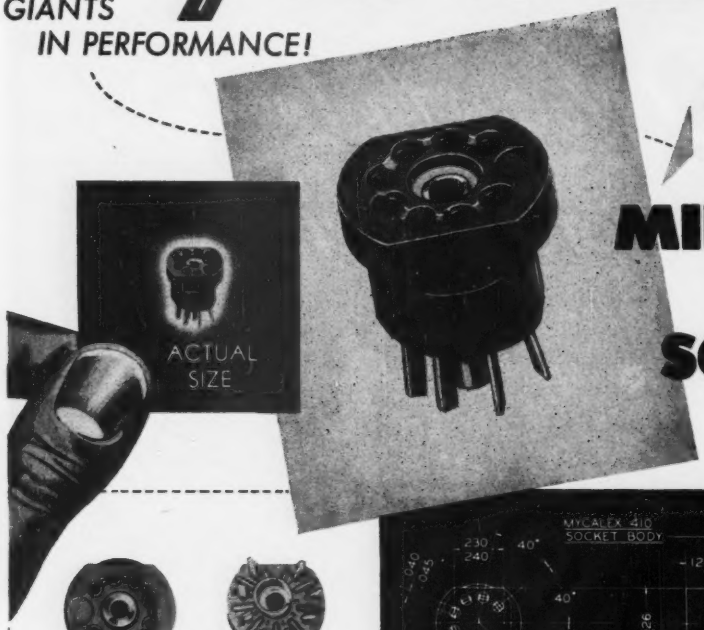
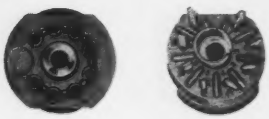
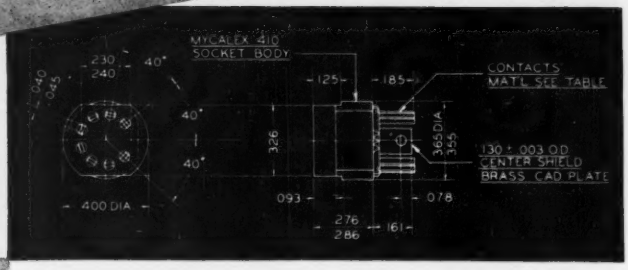




TOP VIEW

BOTTOM VIEW



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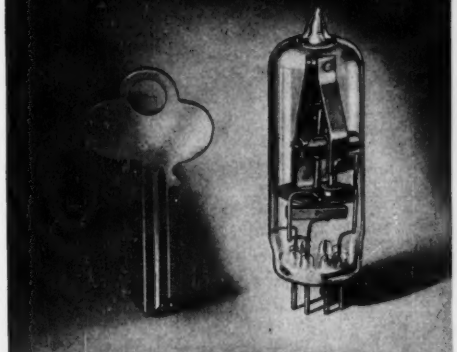

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Weight: ½ oz. (approx.)
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Height: 2¼" maximum (seated)
Standard Heater Voltages: 115v, 27.5v, 6.3v
Contact Ratings: 2.5 amps @ 125v ac., 1.0 amp @ 125v dc.
Ambient Compensation: −60 to +85°C
Nominal Heater Input: 2 watts
Mounting: Miniature Button 7-pin
Range of Delay Periods: 5 secs. to 120 secs.

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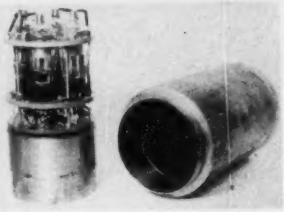

The vacuum-tube unit

bellows which expands or contracts as pressure is applied or removed.

Standard glass bulbs housing the 310-A's are not of sufficient strength to withstand the hydrostatic pressures encountered. Therefore, the tubes and related components are mounted in steel cylinders, four tubes to a cylinder. Since there are 16 tubes total in the two amplifiers, four of these cylinders are required.

Automatic Steering for Outboard Motorboats

By SAMUEL E. DORSEY
Electronic Engineer
Research Department
Naval Ordnance Test Station
China Lake, Calif.

AN AUTOMATIC STEERING DEVICE for an outboard motorboat is desirable to reduce fatigue resulting from continuous operation of the steering lever.

Most outboard motors are equipped with either a spring device, which causes the boat to proceed in an approximately straight line while not being steered or a variable-friction device by means of which the same thing can be accomplished. However, if the wind is strong and the water is at all rough, the boat can be very quickly thrown badly off its course. Even in calm conditions, the craft will not stay on its course for long.

In the writer's opinion, the important requirement of such an automatic steering device, nonexistent in any spring or friction principle, is that it maintain for fairly long distances and periods of time an approximately straight course, returning to it without manual aid when thrown off by wind or waves. Also, it must be simple and require very little power to operate.

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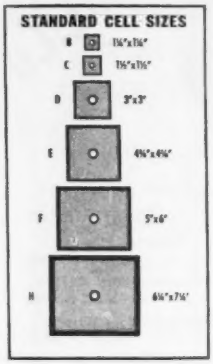

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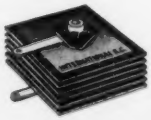

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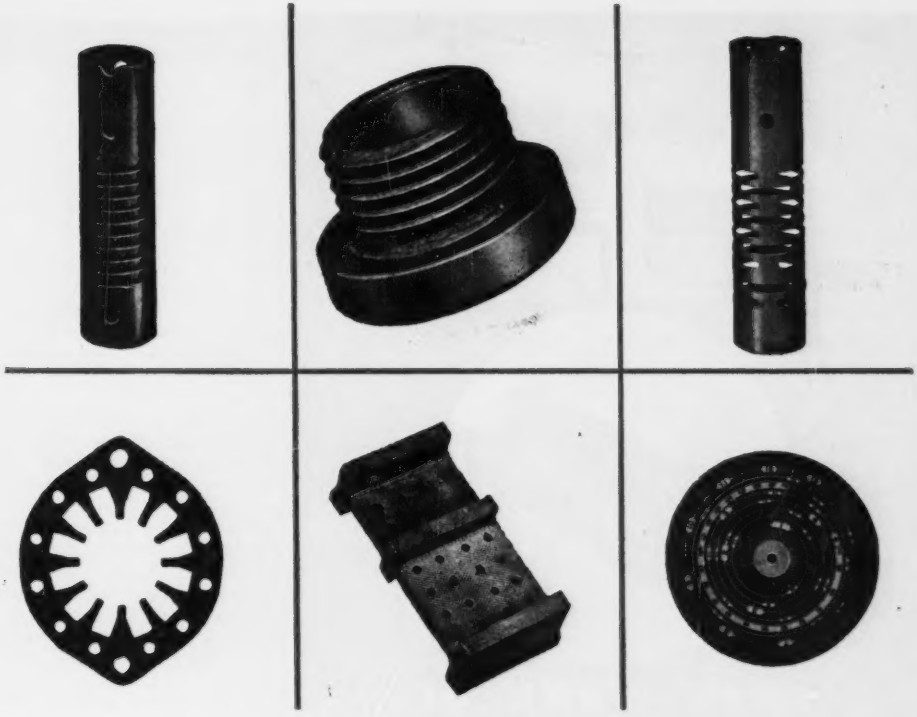

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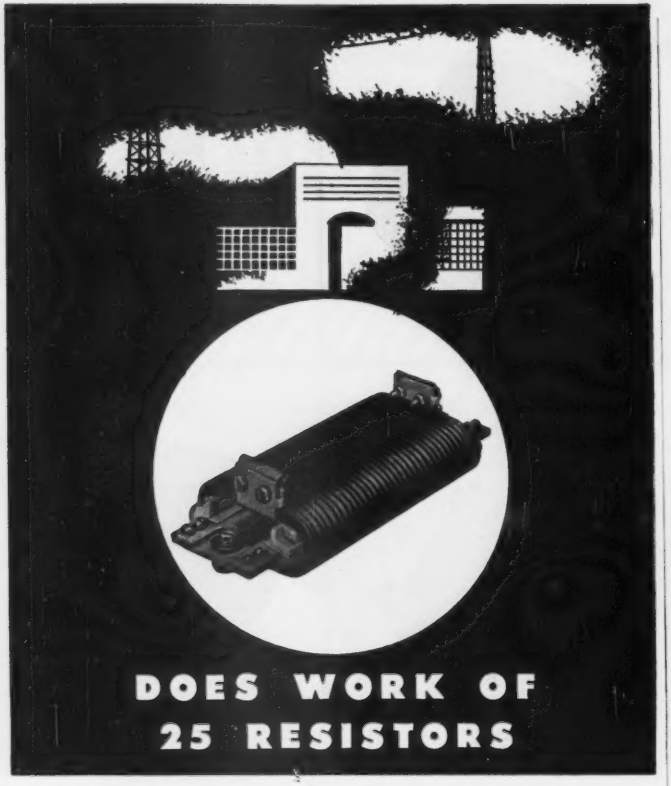

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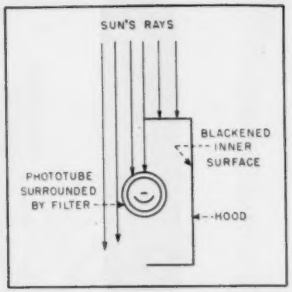
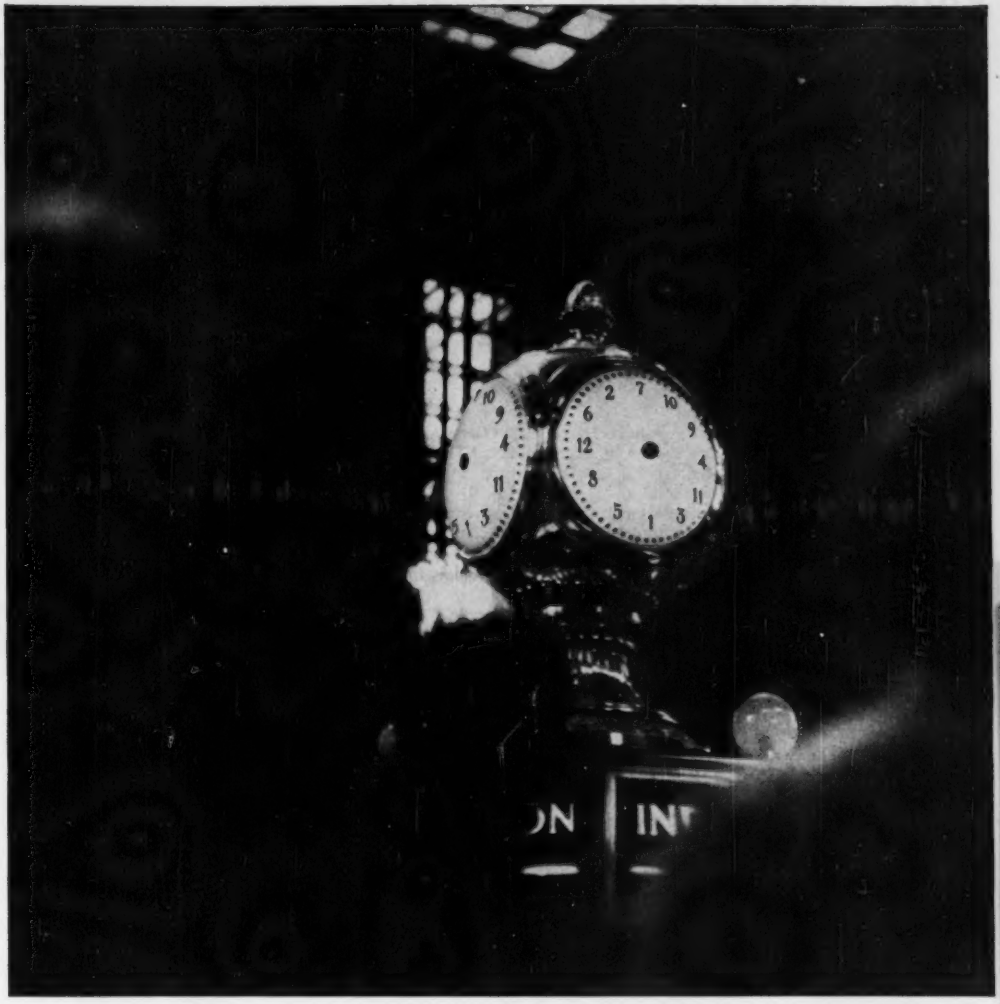


FIG. 1—Direction-sensing mechanism of experimental model

turn to the course, after once being thrown off it, can be realized only through the use of some form of servo-system. A continuous-type control, as is applied in larger automatic steering systems, might conceivably be utilized in the outboard motorboat, but an on-off or relay-type control has the advantage of simplicity and low power consumption. This paper deals with such a relay-type automatic steering system.

To describe the action of the control, a cycle of operations is followed through. Assume that the boat is exactly on its course and that the rudder is in one of its two stable positions wherein it is steering the boat gradually to the right. After the boat has turned a few degrees to the right, the rudder is changed into its other stable position, that of steering gradually to the left. Then, when the boat has turned through the course line, and a few degrees to the left, the rudder is returned to the first-mentioned position. Again the boat moves back toward the course line and the process repeats itself. Thus, the boat follows a slightly zig-zagging path around the true course set for it. On first thought, this sort of control would seem rather impractical but the system was thoroughly tested and found to operate very well.

The apparatus comprising the system may be divided into two general sections: the electronic portion and the mechanical portion. The electronic portion consists of the direction-sensing organ and a suitable amplifier, the over-all function being to translate the information of whether the craft is headed



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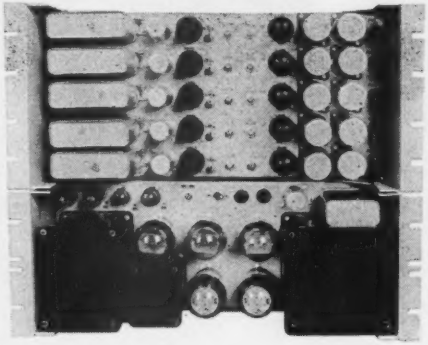

TYPE 1311 Video Distribution Amplifier is specifically designed to distribute video or synchronizing signals to several outlets. Thus, five separate equipments can be fed from a single synchronizing signal generator and monoscope combination.

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OUTPUT IMPEDANCE:	To match 75 ohm lines.
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VOLTAGE GAIN EACH CHANNEL:	Adjustable from 0.9 to 1.1.
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NUMBER OF CHANNELS:	5 separate channels.
FREQUENCY RESPONSE:	Pass 60 cycle square wave undistorted. No overshoot on 100 KC square wave Down 3 DB @ 11 MC. Down 6 DB @ 13 MC.
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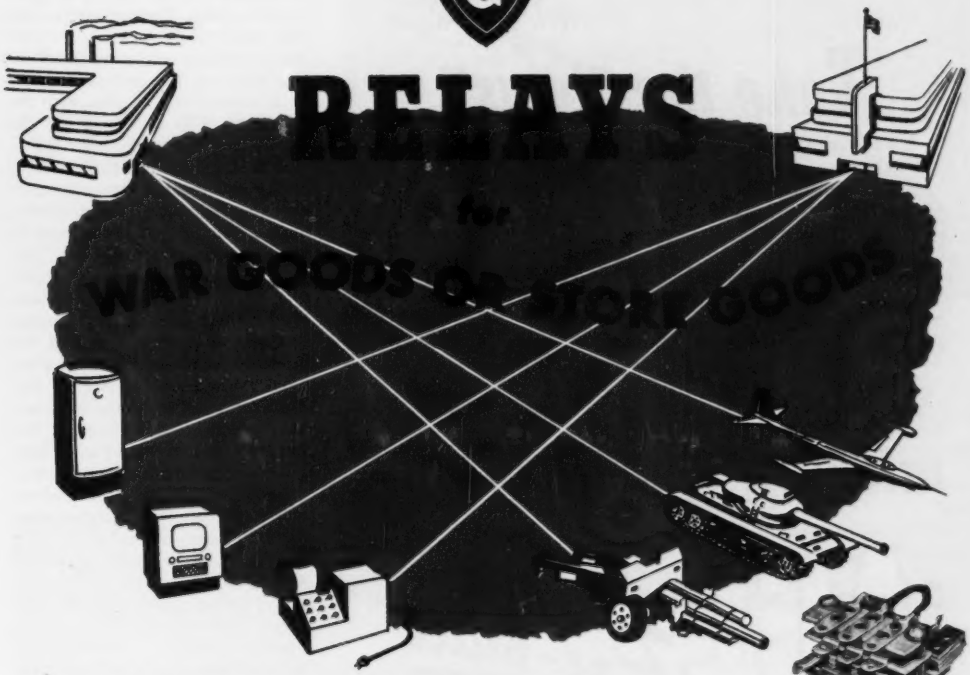

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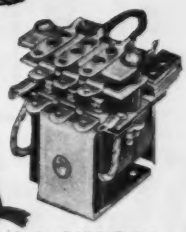

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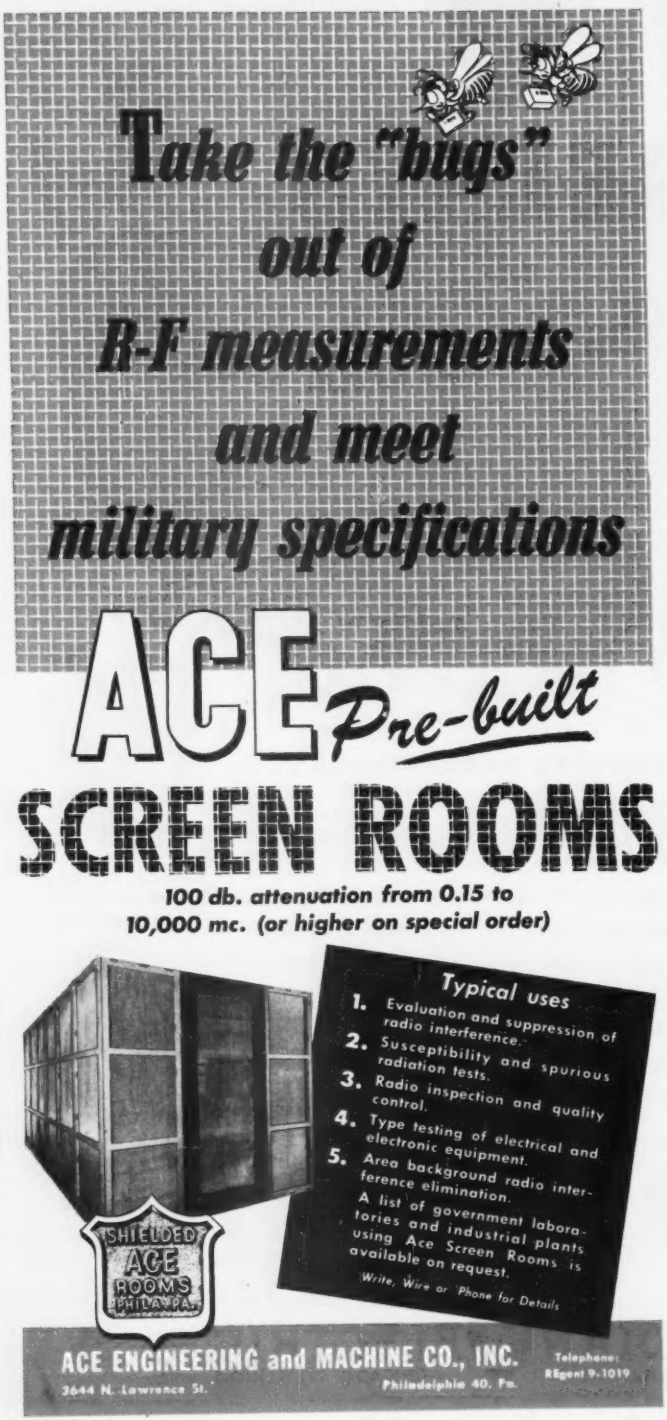
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toward the right or left of the preset course into the closing or opening of a relay. The mechanical portion consists of an electric motor whose purpose is to move the steering lever of the outboard motor from side to side coupled with the necessary parts for conveying the motion to the steering lever.

A balance between extreme simplicity and greater versatility governs the choice of direction-sensing organ. Simplicity is the keynote in the experimental model. Diagrammed in Fig. 1 is a vacuum-type phototube, hooded to one side of its cathode surface. It is mounted vertically in such a way that the tube-and-hood assembly can be rotated throughout 360 deg of azimuth, with respect to the boat, and fixed to point in any direction. The phototube is surrounded by a filter to prevent ambient light from saturating it. (Two layers of masking tape serve very well.) In application, after deciding in what direction the boat is to go, the phototube cathode surface is set pointing in the azimuthal direction of the sun. Figure 1 illustrates the on-course condition. Sunlight strikes half of the phototube. It is obvious that as the boat veers to the right of the course, sunlight will impinge upon more of the phototube; to the left, less.

A more versatile direction-sensing organ makes use of a magnetic compass with some form of pickup. It is recommended that the compass be of the moving-dial type in an arrangement as shown in Fig. 2. Half of the surface of the dial is painted white, the other half a dull black. A small pencil of

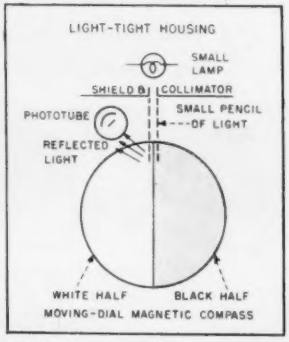
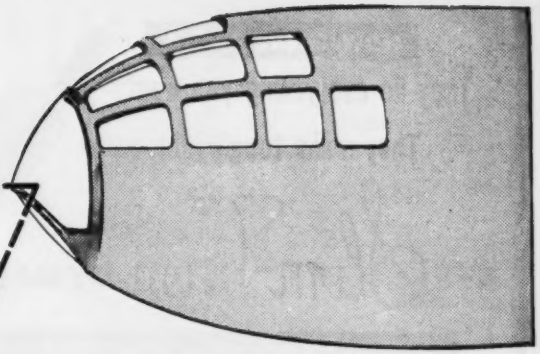


FIG. 2—More versatile direction-sensing device

VISIBILITY



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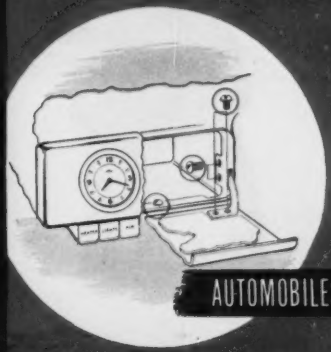

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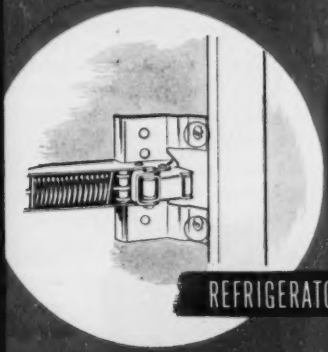

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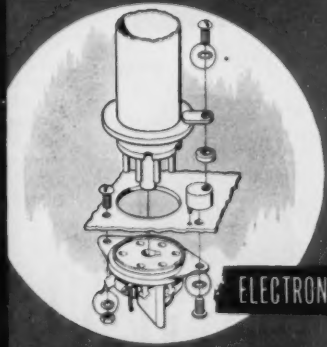

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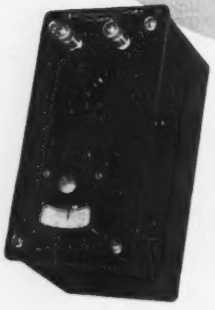

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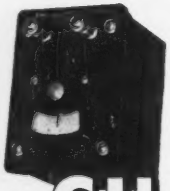

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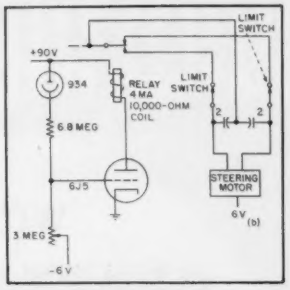
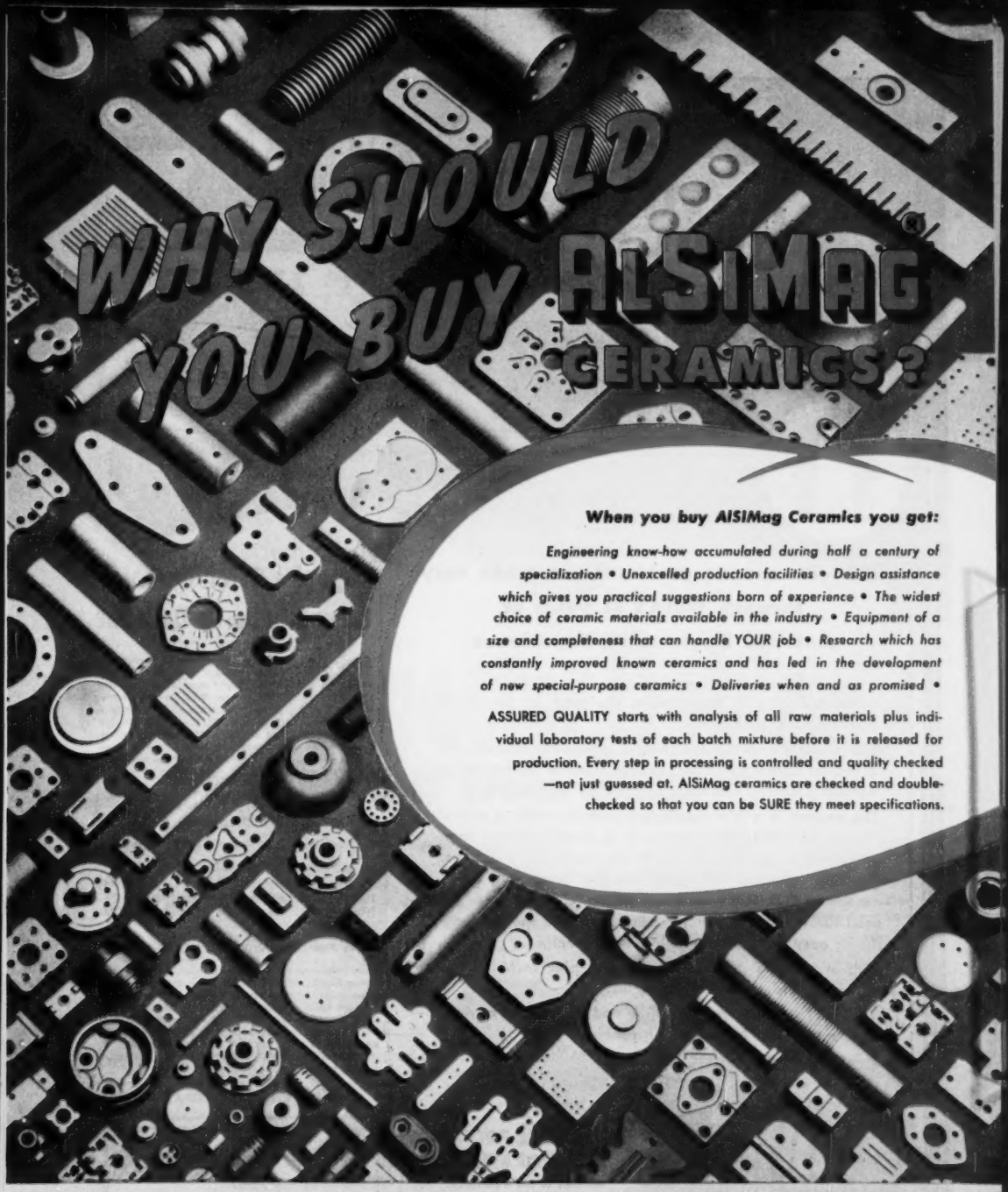


FIG. 3—Simplified diagram of experimental model

artificial light is trained on the dial and a phototube is situated so as to receive light reflected from the dial. The assembly is placed in a light-tight housing which can be rotated to change the course. As with Fig. 1, the on-course condition is illustrated. Again, it is obvious that as the boat veers to the right of its course, more light will reach the phototube; to the left, less.

The amplifier must have adequate gain and power capability to operate a relay satisfactorily from the signals generated by the phototube. The relay must be sufficiently rugged to handle the current drawn by the steering motor. Presumably, it might consist of a very sensitive relay driven directly by the phototube current, perhaps coupled to the more rugged relay. Figure 3 shows the single-stage amplifier circuit employed in the experimental model. For the more versatile sense organ, with the low light levels at which it operates, two stages of amplification may be necessary. In any case, it can be seen that the greater the gain, the smaller the angle subtended by the boat between pull-in and drop-out of the relay, with resultant less wide zigzag of the boat. In addition, some form of control of gain or bias is needed to set the points at which the relay responds.

It is almost a necessity that the steering motor be operable from a single six-volt automotive-type battery or, better still, an even smaller power source. It must be geared to a device which transmits lateral movement to the steering lever of the outboard motor, to the right when the steering motor is run in one direction and to the left when the steering motor is reversed. This



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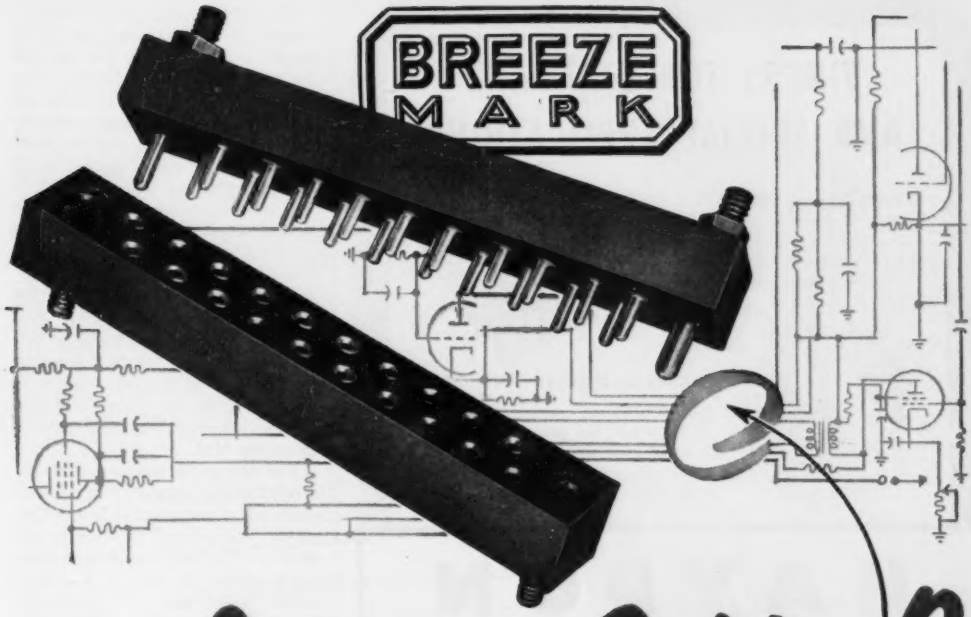

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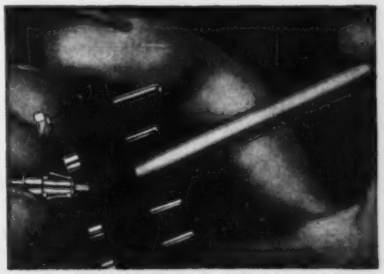

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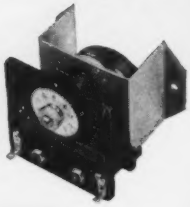

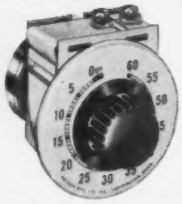

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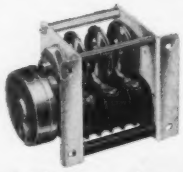

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lateral movement must be fairly rapid, taking only a few seconds at most. The end-positions of the steering lever must be easily adjustable, because a larger amount of control is necessary when heading into or across a heavier swell than when riding with the swell or in calmer waters. To conserve power, limit switches should be installed so that the steering motor will cease to draw current after each lateral movement of the steering lever. Figure 3 shows this connection. The capacitors are for arc suppression. In the interests of safety, it is of utmost importance that provision be made for swift assumption of full manual control at any instant.

For the experimental model, an aircraft antenna reel assembly was obtained, a war-surplus item. The motor is designed to operate on 28 v but after removal of the clutch-brake spring, it runs on 6 v at a usable speed and with sufficient torque for the purpose. Movement of the reel-spool is limited to a half-turn by the installation of stops and limit switches. These are engaged by a projection attached to the under-side of the reel-spool. It is necessary to pad the stops with rub-

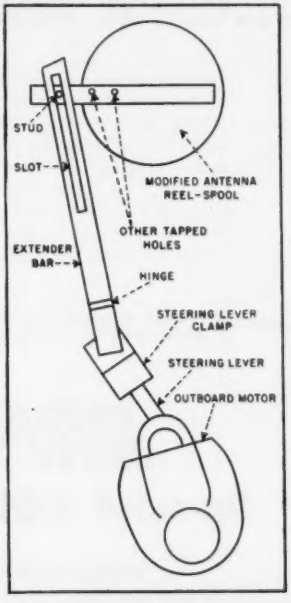
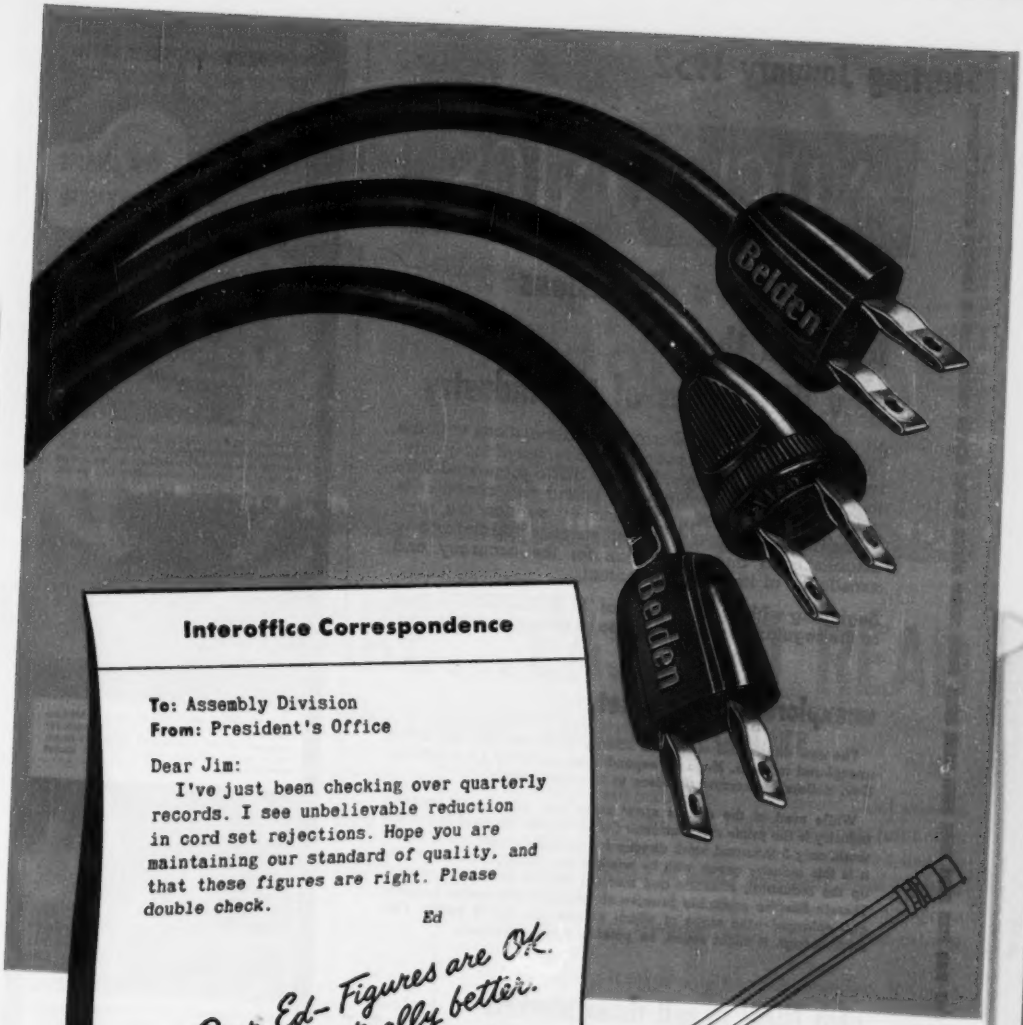


FIG. 4—Mechanical connection to outboard motor as used in first model



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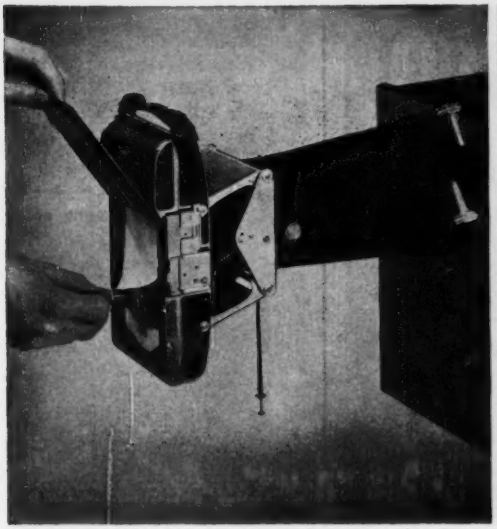

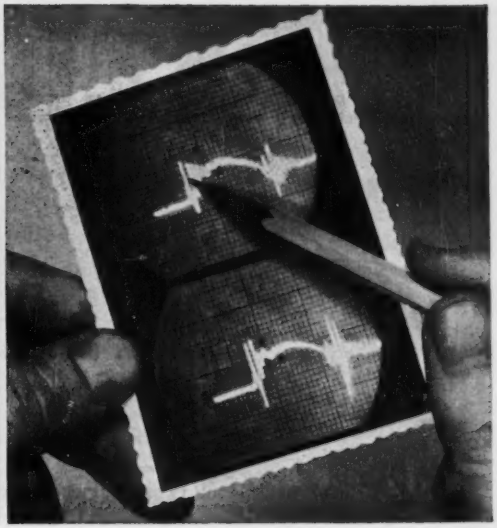

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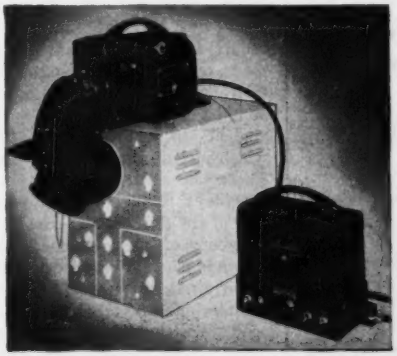

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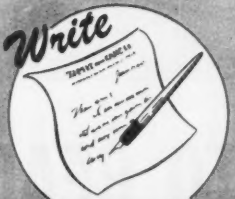

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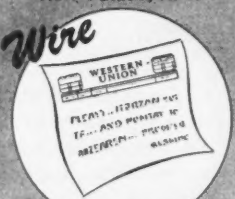

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ber. Otherwise, the gears bind.

Figure 4 shows the connection to the steering lever. The extender bar is hinged to the adjustable steering lever clamp and slotted in its forward section. The bar receives the lateral component of the half-turn of the reel-spool by the engagement of its slot with a stud on the spool. Gravity holds the bar against the stud. The stud mount on the surface of the spool is provided with tapped holes at various distances from the center for adjustment of the end-positions of the steering lever. The safety-feature of immediate manual control is brought about by simply lifting the extender bar off of the stud.

The author wishes to express his appreciation for the assistance rendered him in the construction of the experimental model by the men in the electronic and machine shops of the Ballistics Division, Naval Ordnance Test Station.

F-M Performance Measurement Form

BY JAMES H. GREENWOOD

Chief Engineer
Station WCAE, WCAE-FM
Pittsburgh, Pa.

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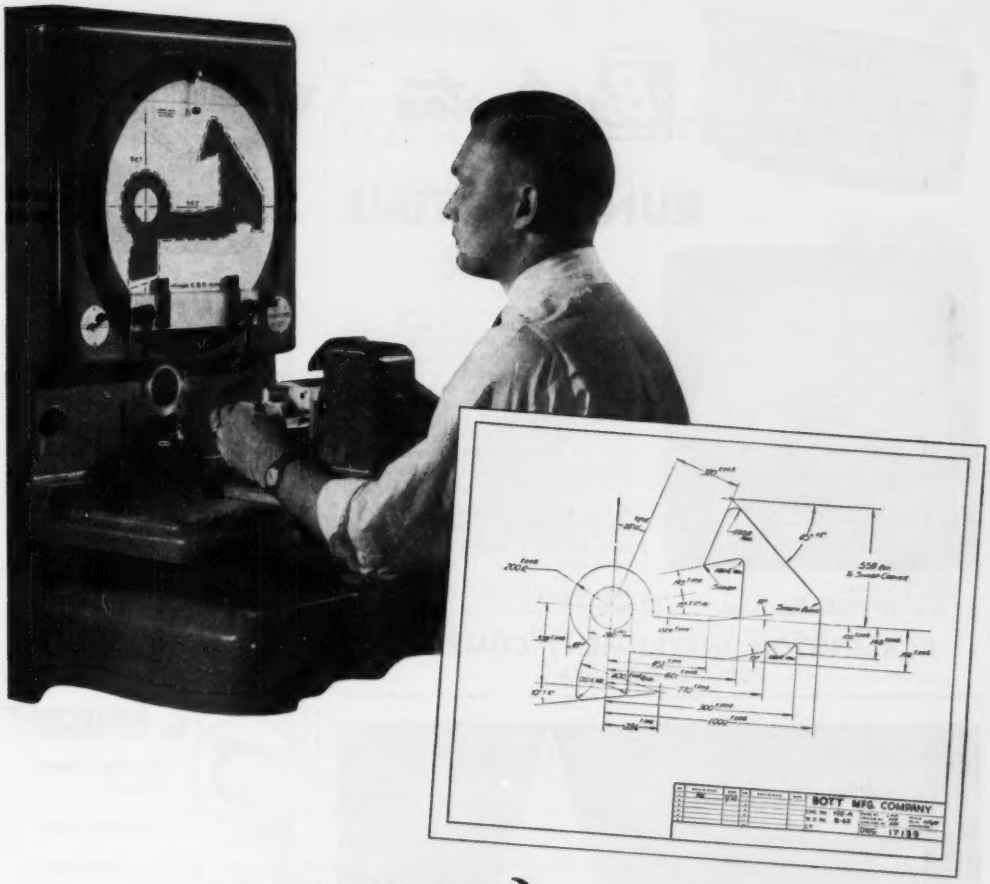

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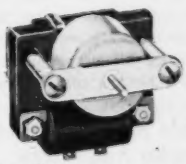
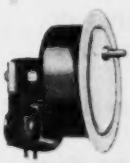


Type H3 Motor — For medium-duty switching, controlling and recording-controlling, such as time switches, business machines, time stamps, system clocks for public buildings, household door chimes and recording instruments.



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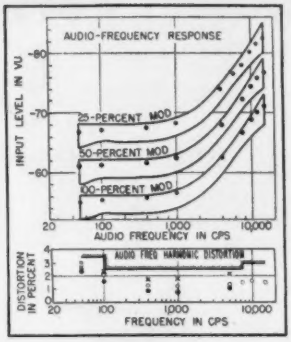

FIG. 1—Sample of performance measurement form

put level is determined for different frequencies. The graph of frequency response is therefore a plot of frequency versus input level. Three plots are made, one for each modulation level.

Since the difference between 100 and 50-percent modulation and between 50 and 25-percent modulation is 6 db, the tolerance ranges have been plotted 6-db apart. The illustrated graph has plotted on it a typical series of measurements.

Only one graph is used for plotting distortion at the various levels of modulation since the tolerances are the same. Different colors or shapes are used to indicate the measured points at the different modulation levels. Identification of the colors used should be included on the graph.

Space should also be provided on the graph (not shown) to list the type and make of measuring equipment used. In addition, it is advisable to attach to the graph a copy of the detailed instructions which were followed by the measuring personnel. These instructions will of necessity be different for various stations. They not only serve as description of the measurement technique but also assure that the measurements are made in the same manner by all personnel and are therefore always comparable.

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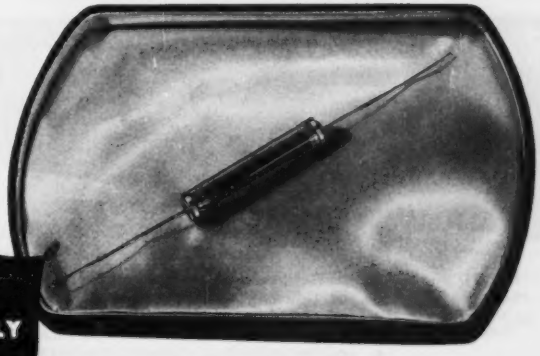

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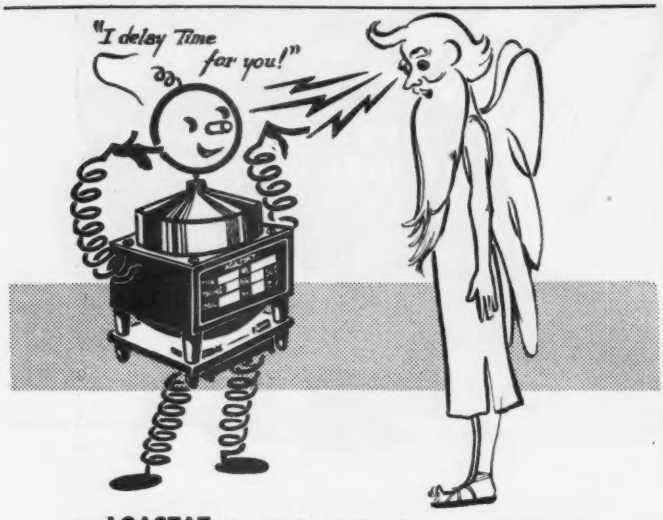

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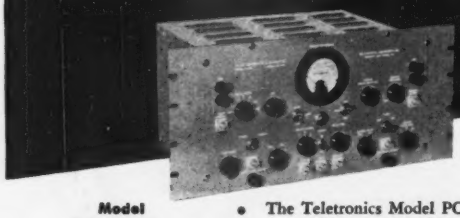

Model PC-100 R illustrated here

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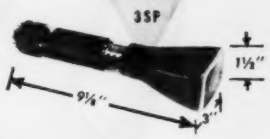

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The R-C coupled circuit shown in Fig. 1 may be connected to a low-level stage of an audio amplifier simply by attaching a wire to the plate pin of one tube and making an a-c ground connection.

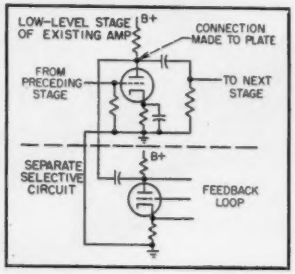

FIG. 1—Method of connecting the selective circuit to the amplifier

Since audio amplifiers are more or less standardized in design, the logical place to connect an external source of selectivity is between the plate pin of the last voltage amplifier and ground. Connection to a tube involved in a negative feedback loop is not desirable since the expected selective response will not result. In this case, it would be better to choose a lower-level stage outside the feedback loop.

Perfect rejection of a particular frequency may be obtained with the circuit. A Q of around two or three is suggested for general use and a maximum level of the order of 20 volts rms is a good operating point for the external circuit.

The material in this article was abstracted from page 726 of *The Review of Scientific Instruments* for October, 1951. The original article by O. G. Villard, Jr., was entitled "A Tunable Shunt Selector-Rejector for Audio Amplifiers".

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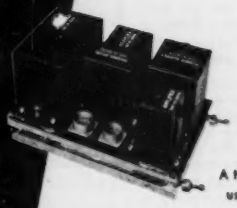

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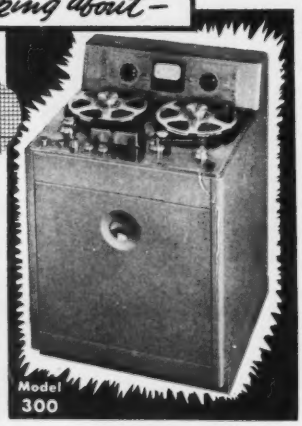

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THE ELECTRON ART

(continued from p 142)

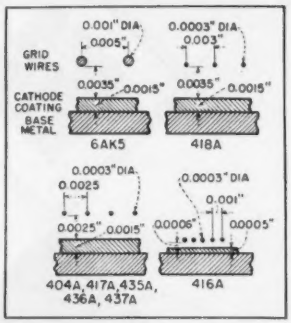

FIG. 1—Close spacing and small grid wire size provide improved transconductance to capacitance ratio

The tension must be high to minimize microphonic effects and short-circuit hazards. The wires are wound under a tension of somewhat more than half the breaking strength. There are about 300 wires, altogether, on a single grid, each under a tension of the order of 10 grams, so the total load is about 3,000 grams, or about 7 lbs. Figure 3 shows the construction of the tube, which is conventional except for the frame grid.

The molybdenum frame is fabricated by welding the cross straps to the side rods. After winding, the grid wires are secured to the side rods by spraying the contacting areas with a powdered glass suspension and heat treating. A thin layer of gold is plated onto the grid to inhibit emission of electrons.

The broad-band tubes described have been designed in such a way

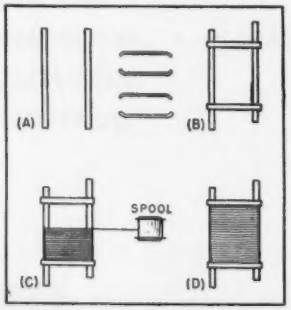

FIG. 2—Welded grid frame structure permits use of finer wire with closer spacing

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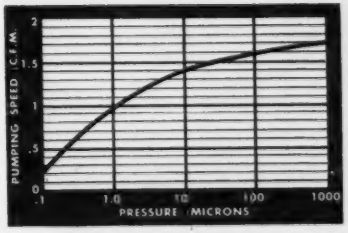

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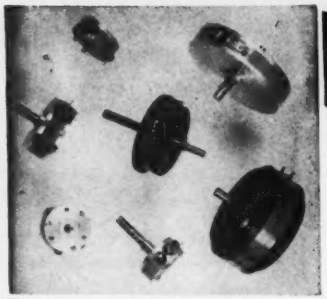

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Weight (oz.)	15	6	3	2	1
Mounting: 3 holes 1/8" deep	#8-32	#8-32	#8-32	#6-32	#4-40
Mounting circle diam. (in.)	3.250	1.750	1.250	1.000	1.000
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Min. resistance (ohms) ± 10%	460	250	150	105	80
Max. useful angle (deg.)	358 ±1/2	356 ±1/2	354 ±1/2	352 ±1/2	350 ±1/2
Max. resolution (%)	0.05	0.08	0.15	0.2	0.25
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4. Correct temperature.

Cleaning

All oil, grease and other foreign matter, and oxides if present, should be removed. Visual inspection cannot be used to detect this oxide. Either a file or grinding will remove the oxide to get to the base metal. On production basis usually a bright dip is used. In some plants this is done as parts are needed on the assembly line to prevent oxidation prior to use.

Although there are acid-base fluxes which may be used to remove the oxides more readily, they are not normally accepted in production work as all of the flux must be removed promptly after soldering or brazing to prevent future corrosion of the metal.

Fluxes

With the exception of the acid-base fluxes mentioned above, the main purpose of a flux is to cover the parts with a film which will exclude air during the soldering or brazing operation since oxidation is speeded up when heat is applied. The fluxes should melt well below the melting point of the solder to protect the surface while being heated to soldering or brazing temperature.

Resin or borax are generally selected since they are considered non-corrosive and it is not necessary to remove them after joining. Sal-ammoniac and zinc chloride are also used but they must be removed after the joining is completed to prevent corrosive attack. In brazing, calcined borax and boric acid in powdered form are quite commonly used.

There are many proprietary fluxes on the market which are available for soldering and brazing and in many cases are superior.

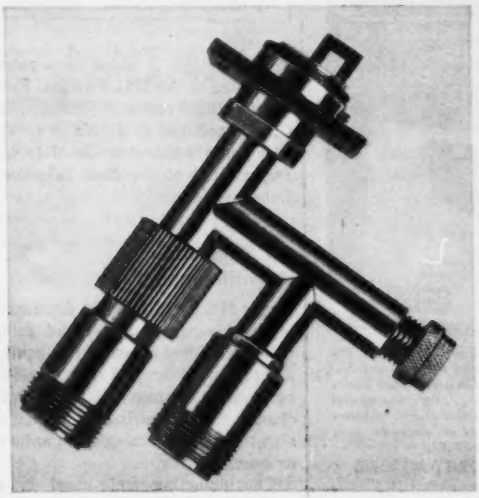


Illustration shows crystal mixer made from copper base alloy components are silver soldered together

Hold Work Closely

As solder and brazing metal flows through capillary action, it is important that the parts being joined be held closely together. Too large a space between the parts will prevent the molten bonding material from flowing and sealing tightly over the entire area. A good example of this is where corners of rectangular boxes are being soldered or brazed. It is often necessary to use a tight jig or clamp to insure intimate contact between the parts.

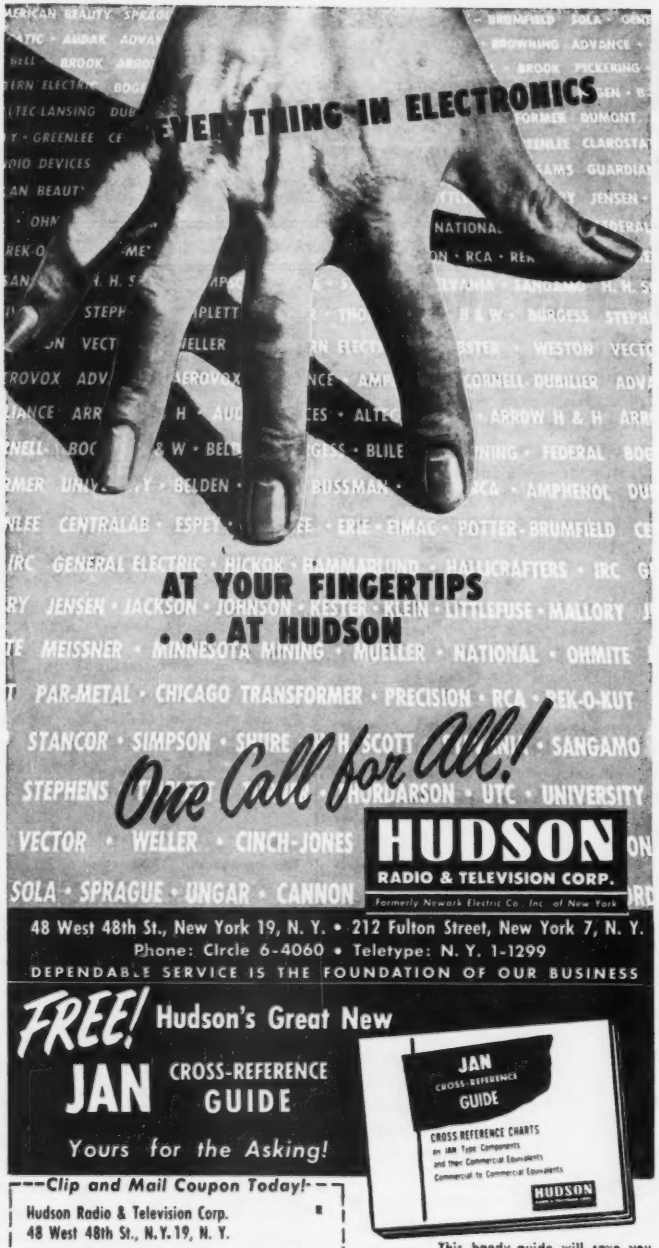
Correct Temperature

The parts being joined should be heated slightly above the melting point of the solder or brazing material. When using a soldering iron, care should be taken to insure that the copper tip of the iron is heavy enough to maintain sufficient heat to carry out the operation. When using a flame in soldering, care should be taken not to overheat the metal as oxides would form too rapidly and the flux would be burned off and the metal softened to too great a degree.

In brazing or "hard soldering" a gas-air or gas-oxygen flame is normally used, although with care oxyacetylene torches can be employed since higher temperatures are needed than in soldering. Red heat is needed for this type of joining. Again, too high a heat on the part will burn off the flux and cause the metal to oxidize thereby weakening the bond. The flame used should be a reducing one (excess of fuel in the fuel-to-air ratio) or a neutral one.

In furnace brazing a reducing atmosphere is also helpful to prevent oxidation and to remove any oxide which might be left on the metal.

(7755)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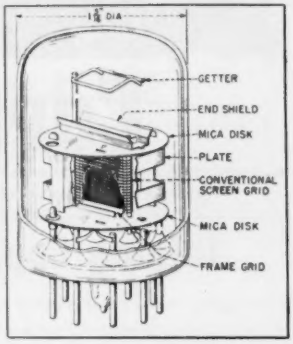


FIG. 3—Structure is rigidly supported from stem which eliminates distortion when bulb is placed over the mount

that they can be manufactured on a production line that differs very little from ordinary tube lines. Moderate cost is therefore assured. Table I shows a comparison between one of the broad-band tubes and the familiar 6AK5.

TABLE 1—Broad-Band Performance Comparison

	6AK5	435A
Plate Current	7.5	25 ma
Screen Current	2.5	8 ma
Transconductance	5,000	28,000 μmhos
Input Cap.	3.9	15.2 μμf
Output Cap.	2.85	3.3 μμf
Center Freq.	60	4 mc
Useful B-W	5	8 mc
Voltage Amp.	15	30 db
Eq. Noise Res.	1,770	210 ohms

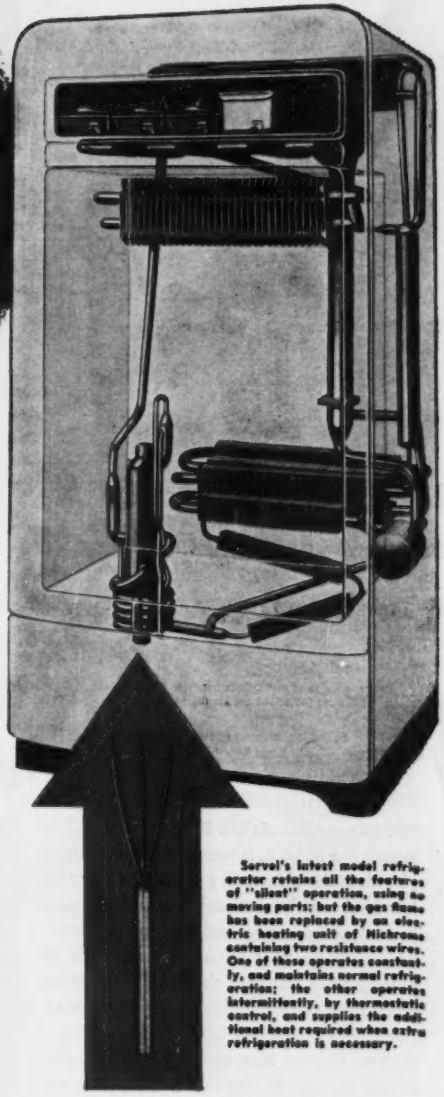
This article is based on a paper presented at the 1951 National Electronics Conference in Chicago, by G. T. Ford and E. J. Walsh of the Electronic Apparatus Development Department of the Bell Telephone Laboratories.

An Electronic Pneumotachograph

MANY difficulties arise in determining respiratory volumes and rates by conventional means. The equipment to be described does the job by means of measuring a small change in capacitance brought about by the breathing of an animal or human being.

The detecting unit used is a modified orifice meter instrument detector which relies on a compres-

Servel goes electric with NICHROME*



Servel's latest model refrigerator retains all the features of "silent" operation, using no moving parts; but the gas flame has been replaced by an electric heating unit of Nichrome containing two resistance wires. One of these operates constantly, and maintains normal refrigeration; the other operates intermittently, by thermostatic control, and supplies the additional heat required when extra refrigeration is necessary.

Now the famous silent Servel refrigerator operates on electricity. In the new refrigerator, a simple electric heating element provides heat for operating this absorption-type system. Just plug it in, and the new Servel goes to work . . . provides the *soundless* performance for which it is famous.

Since cold is obtained without a single moving part by means of heat applied to the system, the small heating element is the vital part of the new Servel. Every operation of the refrigeration cycle, indeed, depends upon the heater unit *staying on the job.*

Because of this, Servel has adopted heating elements made with Nichrome—the electrical resistance alloy that is the very heart of quality appliances everywhere. Remarkably resistant to high heat and corrosion, and able to retain its physical and electrical properties despite thermal shock resulting from intermittent operation day in and day out, Nichrome assures Servel of efficient operation and a lifetime of dependable service.

Whatever *your* requirements for electrical resistance material, it will profit you to consult with us. In addition to world-famous Nichrome and Nichrome V, we produce over 80 alloys to meet the varied needs of the electrical and electronic fields. Although strategic materials and the alloys we make from them are on strict allocation at the present time, we'll be pleased to serve you to the best of our ability.

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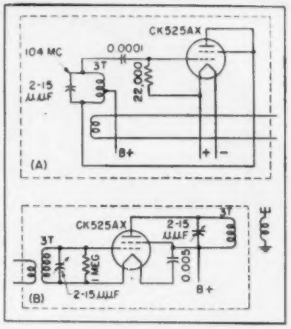

FIG. 1—Circuit of f-m oscillator and amplifier for telemetering respiratory information

sion of air on the face of a fine mesh screen to produce a local increase in pressure relative to the effluent side of the screen. The region of elevated pressure produces an increase in pressure within the orifices of the side tubes which are connected to a detector coupling. When air flow is reversed, there is a concomitant drop in pressure to less than ambient. A fine copper mesh is caused to deflect in accordance with pressure changes, and its deflection is converted into capacitance variations which in turn modulate the output of an f-m oscillator, the circuit of which is shown in Fig. 1A.

The buffer amplifier (Fig. 1B) is almost a necessity on ambulatory patients, since changing position with respect to large metallic objects would cause a misleading change in frequency if the antenna were connected directly to the oscillator. The oscillator alone weighs 430 grams complete. When assembled with the buffer amplifier the volume doubles and the weight is 780 grams. Figure 2 shows the oscillator, without buffer amplifier, and the pressure actuated capacitor.

In operation, respiratory changes cause the carrier frequency to shift about 0.01 percent during normal breathing. The f-m tuner unit used to pick up the signals is specially designed to have a linear output with respect to changes in input frequency, and limiting reduces effects of amplitude variations.

This development is described in considerably more detail in an un-

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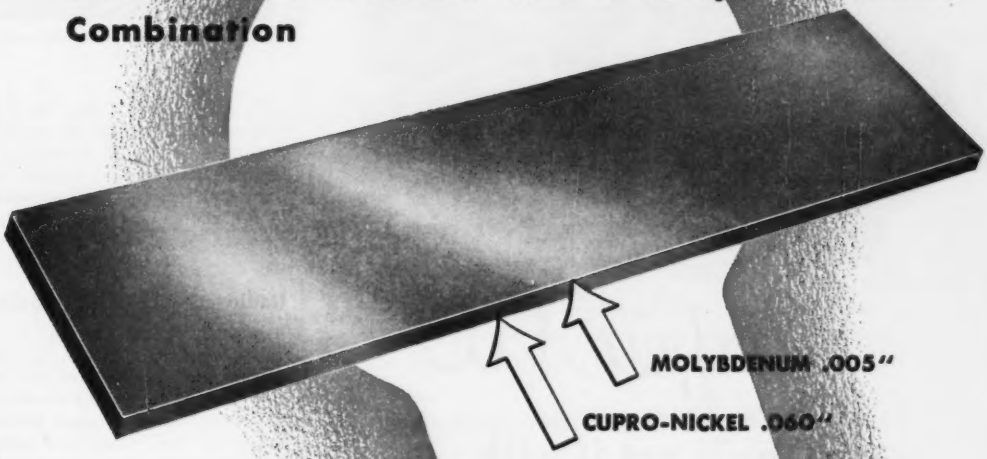

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Copper provided a mechanical problem because it tended to gall.

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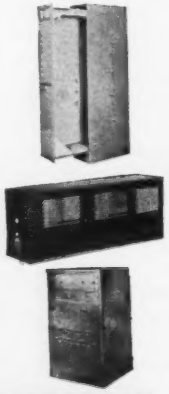

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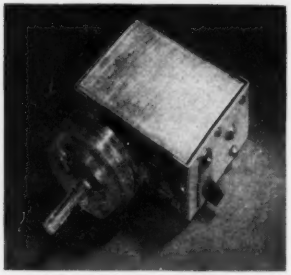

FIG. 2—The oscillator alone weighs 430 grams

classified report entitled, "A New Pneumotachograph and its Application to a Study of Human and Canine Respiration" written by Paul E. Morrow of the University of Rochester Atomic Energy Project.

Radioactive Current Source

RADIOACTIVITY can be used as a source of electric energy (at low levels) through the use of an "atomic battery" recently developed by the Ohmart Company of Cincinnati, Ohio. The conversion of radioactive energy to electrical energy is obtained by a cell made of two dissimilar materials separated by a filling gas, as shown in Fig. 1. When the cell is connected to a current-measuring device and the filling gas is forcibly ionized by exposure to nuclear radiation, the positive ions formed in the gas are attracted to the noble electrode and the electrons are attracted to the active electrode, owing to the difference in work function of the two electrodes, resulting in a generation of an electrical current.

The cell is primarily intended for use in measuring nuclear radiation, but the principle involved can

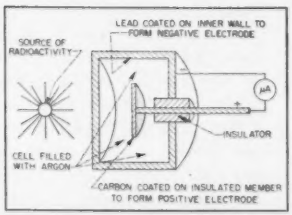
LEAD COATED ON INNER WALL TO FORM NEGATIVE ELECTRODE
SOURCE OF RADIOACTIVITY
μA
INSULATOR
CELL FILLED WITH ARGON
CARBON COATED ON INSULATED MEMBER TO FORM POSITIVE ELECTRODE

FIG. 1—Drawing shows components of battery with radioactive energy source

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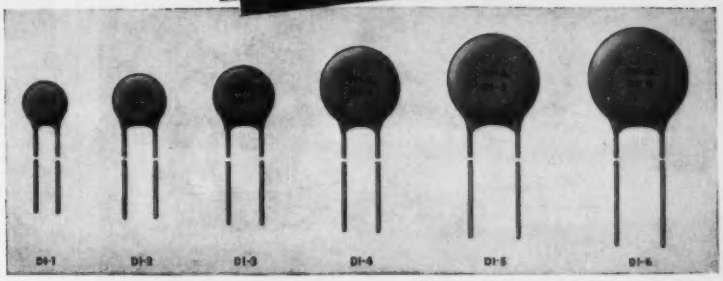

Illustrations approximately actual size.

Temperature Compensating DISK Capacitors

Capacity range from 475 mmf on the DI-6 N1400 material down to .3 mmf on the DI-1 size with tolerances of ± 5% or greater. Conservatively rated for working voltage at 500 volts DC and flash tested at 1500 volts DC. Insulation resistance at 100 volts is well over 10,000 megohms. Electrodes are fired directly to the low loss dielectric and are coated with a non-hydroscopic phenolic for protection against moisture and high humidities. Conform to RTMA Class 1 ceramic capacitors.

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Produced from a recently developed group of extended coefficient ceramics, this type of **Hi-Q** Disk permits a much wider temperature compensating range than was possible on the formerly available normal linear temperature coefficient ceramics. Specifically developed for applications requiring a very large gradient of capacity versus temperature. These new **Hi-Q** Disks exhibit relatively higher dielectric constants permitting capacities in the range intermediate between the high K and linear or normal group of ceramics. The Q (a minimum of 250 at 1 megacycle) is somewhat lower than the Class 1 ceramics. It has, therefore, not been classified by RTMA as Class 1. However, characteristics are superior to by-pass Class 2 ceramics.

Type	Diameter	Lead Width	Thickness
DI-1	5/16" Max.	3/16" ± 1/16"	5/32" Max.
DI-2	3/8" Max.	1/4" ± 1/16"	5/32" Max.
DI-3	7/16" Max.	1/4" $^{+1/8"}_{-0"}$	5/32" Max.
DI-4	19/32" Max.	1/4" $^{+1/8"}_{-0"}$	5/32" Max.
DI-5	11/16" Max.	3/8" ± 1/8"	5/32" Max.
DI-6	3/4" Max.	3/8" ± 1/8"	5/32" Max.

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The widely used **Hi-Q** By-pass Disks are fixed ceramic dielectric capacitors which meet RTMA Class 2 specifications. They are available in the complete capacity range of from .3 mmf to 30,000 mmf. Standard tolerances of 5% thru 20% where applicable can be furnished.

Write for Engineering Bulletin Giving Details of all Hi-Q DISK Capacitors

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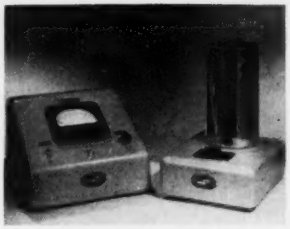
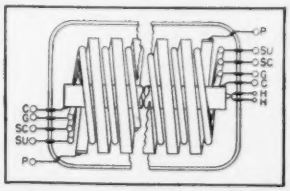


Commercial gammometer that operates on atomic battery principle

also be used for corrosion measurement, analysis of alloys, gas analysis and measurement of vacuum, pressure and temperature. According to Ohmart physicists, the atomic battery is not likely to result in a new source of electrical power for mankind since the amounts of energy so far obtainable in this way were so small. As an example, a battery capable of lighting a 100-watt electric lamp would be a 36-inch cube. However, such a cell would still be delivering current after 20,000 years. The photograph above shows a gammometer that operates on the principle described above.

Transmission-Line Tubes

CHAIN AMPLIFIERS accomplish amplification over greatly increased frequency range by distributing a stage of amplification among a number of tubes rather than attempting to concentrate it in a single tube. A series of special tubes has been proposed that will make possible the use of the chain-amplifier principle with a single tube. The tubes are best described as "homogenized" chain-amplifiers, wherein completely uniform distribution of amplification makes possible increases in gain and decreases in over-all size and power requirements and eliminates the intrinsic bandwidth limitations that exist for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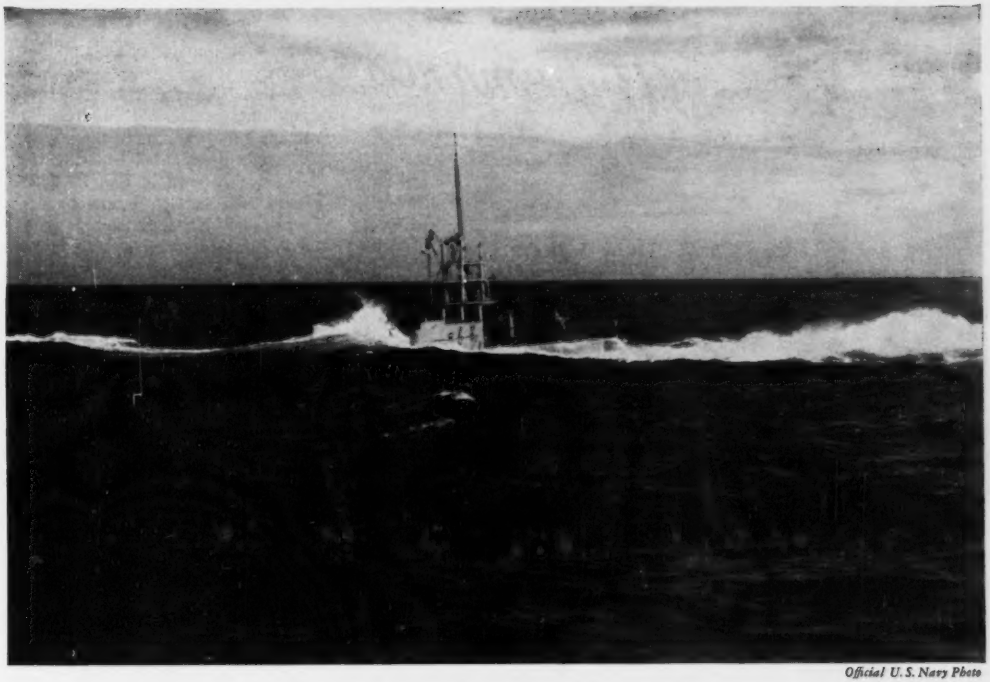

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going down...
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Below periscope level, subs used to grope in the dark, little able to push an effective attack or to strike with accuracy at enemy vessels.

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Now sonar has changed this. Modern subs of the United States Navy, equipped with newly perfected under water detection devices can locate the enemy at great distances and press home attacks from below periscope depth.

Much of this change in submarine tactics can be traced to the electronic laboratories of the Edo Corporation where new types of sonar have been developed to make possible greater range and accuracy.

Edo has become not only a leader in the design and development of many new sonar devices but also is a major supplier of equipments which help make our Navy's fighting ships and subs the best equipped in the world.

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The high power and extreme accuracy of latest depth sounding equipment developed by Edo, has been put to work by the Department of Interior in locating bed rock under deep deposits of sand and silt. The use of this method, first tried in Chicago harbor, and later in the Bay of Fundy, promises to eliminate the costly and time-consuming process of drilling test borings to determine how deep through sand and silt foundations must be driven to provide solid footing on bed rock for dams, piers, and breakwaters.

Over a quarter of a century of experience in the aviation, marine and electronic fields are behind the recent electronic developments which have established Edo as a leader in the whole field of sonar development. If you haven't received your copy of the book describing Edo's first quarter of a century, write to Department 1-M, Edo Corporation, College Point, L. I., New York.

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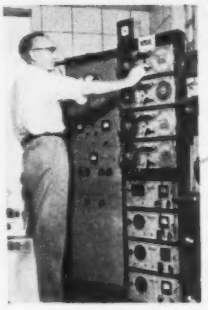

"My daddy flies a jet plane over Korea!" . . . Magnecorders "stationed" in southern Japan perfectly recorded these brave, young words for Americans at home to hear! Easy portability and dependable high fidelity make Magnecorders known to Americans serving at home and abroad.

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PT7 accommodates 10½" reels and offers 3 heads, positive timing and pushbutton control. PT7 shown in console is available for portable or rack mount.

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In rack or console, or in its really portable cases, the Magnecorder will suit every purpose. PT6 is available with 3 speeds (3¾", 7½", 15") if preferred.

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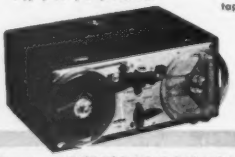
Lifelike tone quality, low distortion, meet N.A.B. standards — and at a moderate price. PT63 shown in rack mount offers 3 heads to erase, record and play back to monitor from the tape while recording.



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CONSERVE VITAL MATERIALS

single-tube and chain-amplifier stages.

A sketch of a simple structure combining uniformly distributed vacuum-tube transconductance with uniformly distributed isolating inductance is shown in Fig. 1. This five-element version might be described as a very long pentode with connections provided at both ends and with a helical plate rather than the conventional cylinder. The distributed transconductance is that between the grid helix and the plate helix and the isolating inductances are merely the self-inductances of those electrodes.

Theoretical studies made of this tube configuration, on the basis of five-wire transmission-line theory, reveal that interaction between lines within the tube can be responsible for useful amplification. The new type of amplification has been named "transmission-line buildup" to distinguish between it, chain-amplifier buildup, and a third type of possible amplification called vacuum-tube buildup.

One of the many possible configurations of transmission-line tubes is shown in mock-up form in Fig. 2. The grid coil form is composed of a number of ceramic beads, which are aligned and connected to each other coaxially by means of smaller ceramic dowels (not visible). Thin micas are sandwiched between adjacent beads, and the cathode is strung lengthwise through small, accurately-punched holes near the periphery of the mica discs and welded to electrodes sealed to the end discs.

After the grid is wound around the form shown in Fig. 2, the grid-cathode assembly is inserted in the

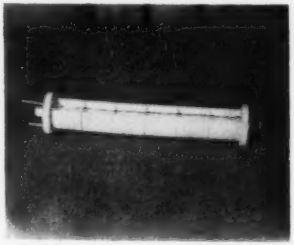

FIG. 2—Laboratory mockup shows enlarged model of grid-cathode structure proposed for use in transmission-line tubes. Grid will be wound helically around ceramic form shown

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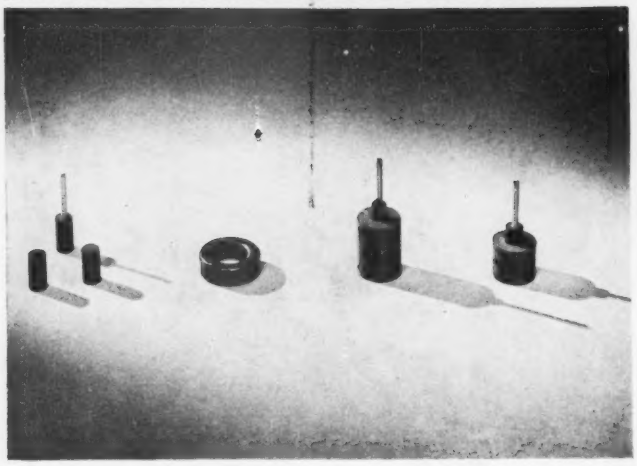
CORE QUORUM



IF YOU USE powdered-iron cores, one of these popular types will most likely solve your inductor problems. If *you* use powdered-iron cylindrical cores, toroids, pot-cores, or cup-cores, Lenkurt offers you an economical source of precision-made parts for quick delivery.

POPULAR DIAMETERS are supplied from stock dies. These include: Cylindrical cores with or without inserts from 0.195 to 3.375 inches; toroids from 0.800 to 3.375 inches; pot-cores from 0.930 to 3.375 inches; and cup-cores of 0.590 and 0.937 inches. Lineal dimensions can be made to meet most specifications.

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Lenkurt

San Carlos 1, California

screen cylinder. This assembly is then enclosed in a ceramic cylinder around which the plate helix is wound.

In describing the proposed line of tubes at the 1951 National Electronics Conference in Chicago, Vernon J. Fowler, Research Assistant at the University of Illinois listed the following advantages:

The principal improvement over other amplifiers is simply that the transmission-line tube can be designed for higher impedance levels and consequently for higher gains per unit length. The maximum impedance level that can be accommodated by other components, such as transmission lines and couplings, transducers, detectors and antennas, determines the amount of gain that can be realized in practice. Additional improvement may be possible if suitable wide-band impedance transformers can be developed; except for noise level considerations it should be feasible to withstand considerable loss in such transformers, since such losses are readily made up in the transmission-line tube at its increased impedance level.

A second improvement is the elimination of an intrinsic upper bound on the band-width. However, since other limitations, such as electron transit-time effects and wave-guide effects, impose physical limitations at slightly higher frequencies than the usual band-width indices, this improvement may not always be very great.

A third potential advantage lies in the bilateral feature of transmission-line buildup. If the multiwire impedance matching techniques that have been developed can be proved workable, transmission-line tubes may have important future applications as broad-band bilateral repeaters.

New British Tube For High-Speed Photos

A NEW TYPE of image converter tube capable of photographing phenomena occurring at one-hundred millionth of a second was shown by Mullard Electronic Products Ltd. at the National Radio Exhibition in England. The introduction of a grid enables the

new GR®

SIMPLE TO USE

VERSATILE

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Reads directly *in Percentage Deviation*

Matches *Pairs of Resistors*

Compares *Resistors to Standard Sample*

Adaptable *to Automatic Sorting and Inspecting*

RESISTANCE LIMIT BRIDGE

Direct Reading in Percentage Deviation over Range of ±20% from 1 Ohm to 1,111,111 Ohms

The new G-R Resistance Limit Bridge uses a conventional equal-arm Wheatstone bridge circuit, supplied from a constant voltage d-c source.

The built-in resistance standard is composed of seven Type 510 Decade Resistors, adjustable from 1 ohm to 1,111,111 ohms in 0.1 ohm steps.

The indicating meter shows percentage difference between the unknown and the built-in standard over a range of ±20% on a meter the scale of which is colored gold for 5% limits and silver for 10% limits as an aid to rapid operation.

A sensitive relay can be substituted for the indicating meter to operate various types of rejection or selection mechanisms for automatic sorting or inspecting.

The instrument can be used as a conventional Wheatstone bridge. Its accuracy is adequate for a large majority of resistance measurements. Its ability to measure resistances up to one megohm without added booster voltages increases its utility considerably.

As a limit bridge its accuracy is ±0.5% or better; for matching pairs of resistors it is accurate to ±0.2%; for null measurements, with an external standard, between 1 ohm and 2 megohms the accuracy is ±(0.2% plus accuracy of the standard).

The instrument is a-c operated from 105–125 or 205–250 volts, 60 cycles. It is supplied in either welded aluminum cabinet or relay-rack models.

TYPE 1652-AM RESISTANCE LIMIT BRIDGE (Cabinet Model) $385
TYPE 1652-AR RESISTANCE LIMIT BRIDGE (Relay Rack Model) . . . 385

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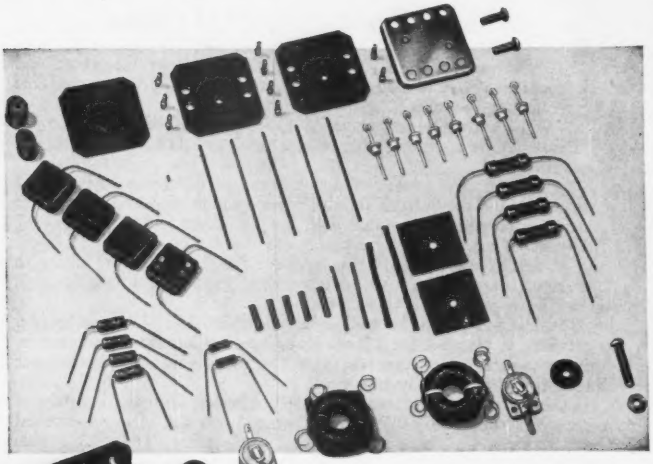


All of these 66 parts are from a single B&W Toroidal-coil type discriminator only 1¾" square by 3½" long exclusive of terminals!

Throughout, the job is one calling for precision components plus a wealth of engineering "know how" in producing and assembling them for maximum performance and effectiveness.

Like all other B & W Special Components, the one illustrated here was designed and produced for a specific application—in this instance a critical military use.

FILTERS

In addition to "tailor-made" discriminators, B & W offers a complete line of performance-proved filters including high-pass, low-pass, band-pass and band suppression types.

TOROIDS

B & W Toroidal Coils of various styles and sizes are available in a wide range of inductance values in open, shielded, potted and hermetically sealed types.

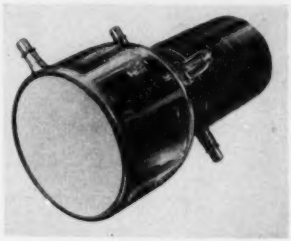
B&W **Barker & Williamson, Inc.**

237 Fairfield Ave., Upper Darby, Pa.

tube to act as an ultra-high-speed camera shutter. The main application of the tube to date has been the study of the rate of burning of explosives, but other uses are expected to be found.

The optical image is focused onto the photocathode. The resulting electrons are accelerated toward a luminescent screen where they form a visible image. Shutter action is obtained by pulsing the accelerating voltage, the picture appearing on the screen for the duration of the voltage pulse.

A number of problems is encountered in the application of these tubes to high-speed photography. The cesium/oxide-silver photocathode shows little sensitivity to the wavelengths of light suitable for single-shot photographic work



New Mullard image converter high-speed photography tube

(4,200 Angstroms). In the Mullard tube, the photocathode is made of cesium/antimony, which has a high sensitivity in the blue region of the spectrum, which is most suitable to high-speed photographic work. A green luminescent willemite screen is normally used, giving a picture of approximately 4½ inches in diameter. The diameter of the photocathode is approximately 1¼ inches so the tube provides image magnification of four times.

During the development of the tube it was found necessary to devise a special technique to make cesium/antimony cathodes with very low resistance in the order of a few hundreds of ohms per unit square as compared with megohms in the case of normal semitransparent cesium/antimony photocathodes as used in photomultipliers and supericonoscopes. These pho-

Solve your Hermetic Seal Problems

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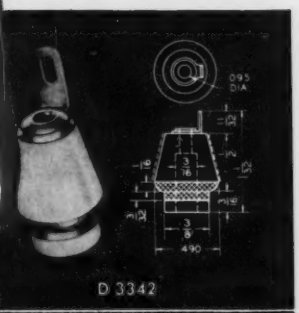

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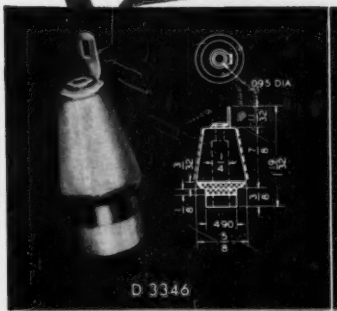

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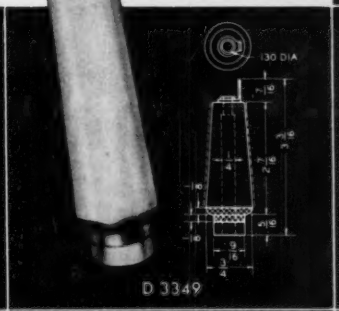

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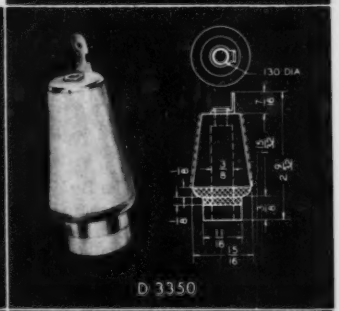

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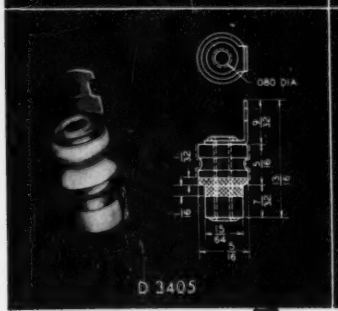

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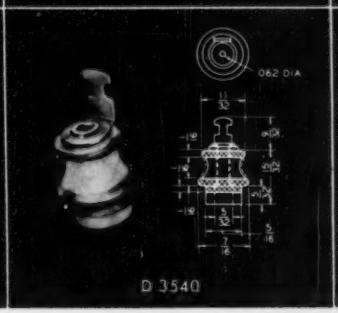

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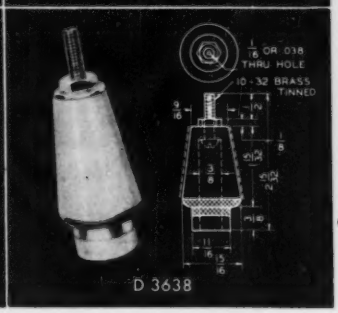

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Specify General Ceramics and Steatite for complete dependability in critical applications

General Ceramics low-loss Steatite sealed leads feature superior mechanical strength that insures permanent, positive hermetic sealing under practically any operating condition. Immune to severe thermal shock, they are easily soft-soldered to closures without developing the strains that are an incipient cause of trouble in many other types of leads. There are no rubber or plastic gaskets to deteriorate. Resistance to mechanical shock and vibration is excellent. The types shown are standard and can be supplied promptly from stock. For complete information on these and for consultation on custom-made terminals to your specification, phone, call or write today.

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Telephone Perth Amboy 4-5100
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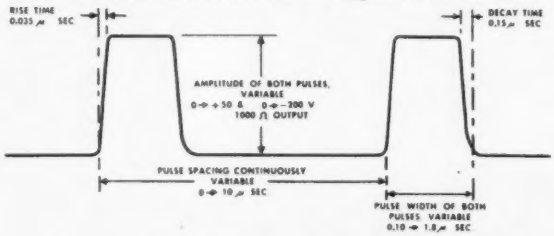
Berkeley

DOUBLE PULSE GENERATOR

DESCRIPTION: The Berkeley Model 903 Double Pulse Generator is a general-purpose laboratory instrument that produces either single or paired pulses. Pulses are individually variable in width, amplitude, and spacing. Pulse polarity is individually selectable. Separate connectors provide impedance levels of 50 or 1,000 ohms for each pulse output.

SPECIFICATIONS

- PULSE DIMENSIONS: Positive or negative as shown below


RISE TIME 0.035 μ SEC
DECAY TIME 0.35 μ SEC
AMPLITUDE OF BOTH PULSES, VARIABLE
0 → +50 & 0 → −200 V
1000 Ω OUTPUT
PULSE SPACING CONTINUOUSLY VARIABLE
0 → 10 μ SEC
PULSE WIDTH OF BOTH PULSES VARIABLE
0.10 → 1.0 μ SEC

- REPETITION RATE: Internally or externally controlled, 1 to 1,000 cycles. Push button single cycle.
- CALIBRATION ACCURACY: Separation dial, ±5% over entire range.
- INPUT POWER: 105 to 125 volts, 60 cycles, 90 watt.
- DIMENSIONS: 14¼" x 9¾" x 10¾"; panel, 8" x 13".
- NET WEIGHT: 18¼ lbs.
- PRICE: $440 F.O.B. factory.

TYPICAL APPLICATIONS: Checking characteristics of high-resolution electronic circuits, gates, switches, wide-band amplifier, measurement of resolution time of counting circuits, etc.

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tocathodes have an average sensitivity of 20 microamperes per lumen to tungsten light at 2,700 K.

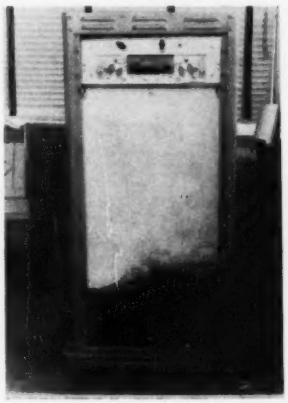
The screens used can resolve 50 lines per millimeter and the light can be efficiently recorded on high-speed orthochromatic or panchromatic emulsions.

The tubes are normally operated at 6-kv anode voltage and 3-kv screen voltage. The cathode of the tube is pulsed with a 60-volt signal. For certain applications, scanning is employed with writing speeds of 60,000 meters per second and a resolution of 1,600 lines across the field of 3½ inches diameter. In high-speed moving film work, exposures can be recorded at a rate of 200,000 frames per second or faster.

Super-Speed Tape Puller For Computer Memory

HIGH-SPEED starting, stopping and reversing with notable mechanical simplicity are features of a new magnetic tape handling machine recently developed at the National Bureau of Standards for use with the SEAC computer.

Using two large tanks for storing tape eliminates need for high-mass reels. These tanks hold 1,200 feet of tape and are just wide enough to



Fast starting and stopping are made possible by elimination of heavy reels. Tape lies loosely in two tanks (one behind the other) just wide enough to clear tape

"Net result . . . . . no net!"

Chrome plate sparkling — baked enamel finish shining — all snugly packed in special cartons and ready to go — 20,000 car heaters. The last of the lot — at a good profit, too! Production costs had been cut to the bone. Bill Johnson was proud of that record, and of the net he would show at the end of the month. Then . . . back came some belated field test reports on a trial shipment. The new electrical insulation on the switch leads, that had cost a few cents less, wouldn't take the heat and vibration, and was cracking off. Unpack — replace insulation — repack — on 20,000 car heaters. Net result — no net!

Often it's little failures that chain react into big losses. Protect your products with BH Extra Flexible Fiberglas Sleeving — permanently flexible insulation.

Specifically designed for low voltage circuits where high heat resistance and flexibility are vital factors, BH Ex-Flex is also important as supplementary insulation. Made without hardening varnish or lacquer it is permanently non-stiffening and retains its flexibility from −67°F to 1200°F, with color retention up to 300°F. It is non-combustible. The easy-to-handle tubular shape provides maximum speed and convenience in installation. Patented braid treatment further reinforced by a special saturant allows BH Ex-Flex to be cut in short lengths, spread to cover knobs and terminals, yet prevents fraying or raveling.

BH Extra Flexible Fiberglas Sleeving is one of a family of BH insulations, each designed to meet particular conditions in service. Give us a few facts about your requirements — product, temperatures, voltages. We will furnish production samples for testing.

Address Dept. E-1

Bentley, Harris Manufacturing Co.
Conshohocken, Pa.

BH *Fiberglas SLEEVINGS**

*BH Non-Fraying Fiberglas Sleevings are made by an exclusive Bentley, Harris process (U. S. Pat. No. 2393530). "Fiberglas" is Reg. TM of Owens-Corning Fiberglas Corp.

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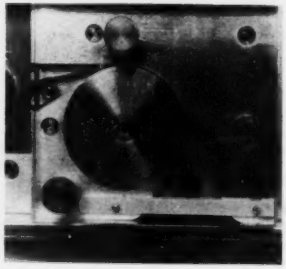
SESSIONS TIMERS

Because Sessions Timers are lower-priced than other dependable makes, a growing number of clock-radio manufacturers are offering buyers a better value for their money.

Make any comparison. See for yourself the price-value superiority of Sessions-equipped clock-radios. In today's more competitive market, this important talking point is your greatest assurance of successful sales. Add the quieter operation, unbeatable accuracy, and attractive styling of Sessions Timers, and you have a total number of important features unmatched by any other clock-radio timer. The Sessions Clock Company, Timer Division, Dept. 41, Forestville, Connecticut.



One of two continuously running rollers against which tape is pressed when movement in that direction is desired. This technique provides very fast acceleration

clear the tape, thus the tape is stored in loose folds without folding or turning.

In the new system, the magnetic tape rests lightly on two smooth-surfaced rollers that rotate continuously but in opposite direction. Between these two rollers the tape passes through magnetic heads for recording, pickup, and erase. When either of two control solenoids is energized, a low-inertia rubber-covered roller presses the tape against one of the smooth rollers. This quickly starts the tape moving in the desired direction.

Electrostatic Charge

Several problems have been encountered in developing the tape memory mechanism. For example, the tape tends to acquire an electrostatic charge as it passes through the drive mechanism. This can become quite troublesome at higher speeds, causing the tape to cling to the walls of the tank as soon as it leaves the drive mechanism. If the charge is strong enough, the tape may continue to stick at the top of the tank until it backs up into the mechanism and is damaged by a sharp fold. At present this problem is being taken care of by ionizing the air where the tape leaves the drive unit using strips of alpha-emitting polonium. The ideal solution would be to make the tape sufficiently conductive so that a charge could not collect. Experiment indicates that base material having a resistance of not more than a few megohms per unit square should be satisfactory.

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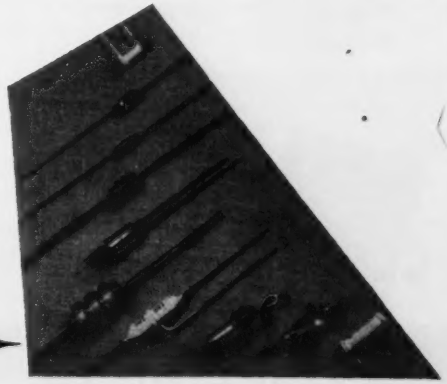
YOUR wants

...if electronic components such as tubular capacitors are your problem

Other electronic components
also built in quantity
to your most exacting specifications
for stability in service



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A SPEER CARBON COMPANY SUBSIDIARY

DU BOIS, PENNSYLVANIA

Complete your Circuits with Resistors, Coil Forms and Iron Cores by Speer Resistor Corp., St. Marys, Pa. another SPEER CARBON CO. subsidiary

Check THESE 7 ADVANTAGES

OF SANBORN DIRECT WRITING RECORDING SYSTEMS

1 COMPLETE SYSTEM or SEPARATE COMPONENTS
Sanborn equipment is available as complete 1-, 2-, or 4-channel systems *ready for use*, or as separate instruments (Amplifiers, Preamplifiers, and Recorders), to be combined or integrated by the user with other equipment.

2 NO INK
Permanent records are produced with heated stylus on heat responsive, continuous plastic coated chart paper. Elimination of ink permits, among many advantages, use of the recorder in any position, at any angle, and at high altitudes.

3 RECTILINEAR RECORDS
Records are in true rectangular coordinates (with *negligible* tangent error), permitting more accurate correlation when two or more channels are used simultaneously.

4 HIGH TORQUE MOVEMENT
The writing arm is driven by a D'Arsonval moving coil galvanometer with an extremely high torque movement (200,000 dyne cms per cm deflection). Sensitivity 10 m.a./cm deflection.

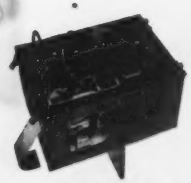
5 WIDE CHOICE OF PAPER SPEEDS AND RECORDING CHANNELS
Basic choice of 1-, 2-, or 4-channel models. Single channel standard speed 25 mm/sec., slower speeds available. Two channels, 10 speeds — 5 and 0.5, 10 and 1, 25 and 2.5, 50 and 5, 100 and 10 mm/sec. Four channel, eight speeds — 50, 25, 10, 5, 2.5, 1.0, 0.5, and 0.25 mm/sec.

6 CODE & TIME MARKINGS
All models provide a means of inserting timing pips in the record once each second independently of the paper drive, and code markings at will.

7 INTERCHANGEABILITY
Ready interchangeability of Amplifiers and Preamplifiers in all Sanborn systems permits a wide variety of recording combinations.

WRITE FOR COMPLETE CATALOG

If your problem involves recording any phenomena (individually, or simultaneous recording of up to four) that can be expressed electrically, you will find Sanborn equipment ideally suited to your requirements.



1-CHANNEL

2-CHANNEL

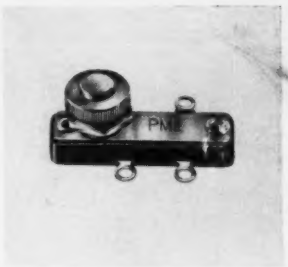
4-CHANNEL

INDUSTRIAL DIVISION SANBORN CO. CAMBRIDGE 39, MASS.

NEW PRODUCTS

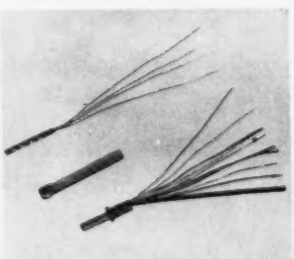
(continued from p 146)

counter are 13 × 11 × 7 in. It weighs approximately 12 lb and operates on 115 v, 60 cycles.



Tiny Panel Mount Switch

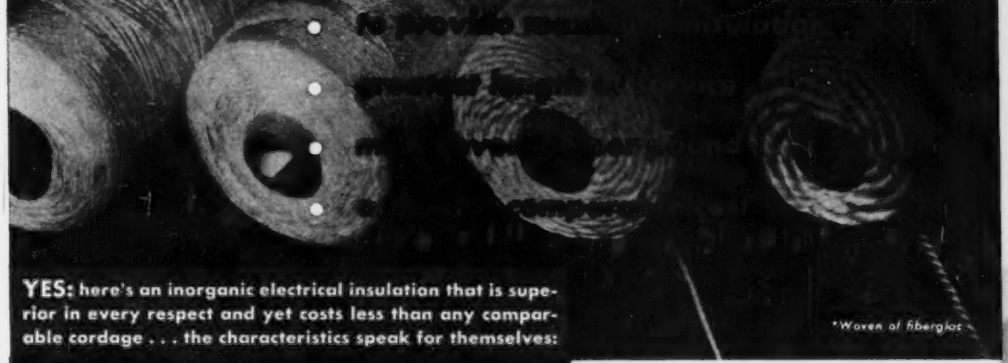
THE SESSIONS CLOCK CO., Tyniswitch Div., Forestville, Conn. Model PM Tyniswitch is a miniature panel mount type measuring only 1⅛ × 7/16 × ¾ in. and weighing approximately 17 grams. It provides precision snap action, long life and high rating at low cost. The new model is UL rated at 15 amperes at 125 v a-c and 7½ amperes at 250 v a-c. Movement differential is 0.010 max. Operating force required is 7 to 11 oz and release force is 2 to 3 oz. It provides the following circuits: spst either normally open or normally closed and spdt.



Subminiature Sliprings

NAER CORP., 631 S. Sepulveda Blvd., West Los Angeles 49, Calif., has developed a line of subminiature sliprings that are fabricated in a special mold which eliminates shrinking, swelling and temperature effects. They feature flexible leads, specially developed insulation which protects against breakdown

features . . . **MIRAGLAS*** *Cords*



YES: here's an inorganic electrical insulation that is superior in every respect and yet costs less than any comparable cordage . . . the characteristics speak for themselves:

- *exceptional high tensile strength*
- *resistance to moisture, oils, corrosive fumes, acids, alkalis*
- *will not rot, stretch or shrink*
- *not affected by fungus*

		DIAMETER	YARDS PER LB.	TENSILE STRENGTH
TREATED	EC9-1-U	.009"	3,620	15
	EC9-2-U	.026"	702	80
	EC9-3-U	.034"	418	125
	EC9-4-U	.052"	209	220
	EC9-5-U	.076"	103	330
	EC9-6-U	.083"	87	420
	EC9-7-U	.095"	65	510
	EC9-8-U	.119"	43	725
	EC9-10-U	.149"	28	940
UNTREATED	EC9-1-N	.0105"	3,240	14
	EC9-2-N	.033"	638	62
	EC9-3-N	.039"	387	105
	EC9-4-N	.062"	193	190
	EC9-5-N	.084"	98	295
	EC9-6-N	.094"	84	340
	EC9-7-N	.110"	61	440
	EC9-8-N	.128"	42	540
	EC9-10-N	.165"	27	750

*Woven of fiberglas

Manufacturers of electrical apparatus and appliances, repair and maintenance departments and rewind shops will find MIRAGLAS* CORDS ideal wherever a high quality binder twine or high strength tension member is required for: banding field and armature coils . . . wrapping string bands on small armatures . . . protecting front of commutator V-ring . . . reset strings . . . tying slot insulation . . . binding on V-ring extension . . . filling in winding coils . . . lashing ends of coils in large motors and generators—and when wax-treated for assembling and tying wire harnesses, etc.

- *MIRAGLAS* CORDS are made by plying fine, strong, flexible fiberglas (filaments of glass). Available either treated or untreated. Treatments: oil, neoprene or wax.*

For MIRAGLAS* CORDS as for all other ELECTRICAL INSULATIONS you can depend upon MITCHELL-RAND "Electrical Insulation Headquarters" since 1889.

Write to MITCHELL-RAND for free samples and descriptive data.

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Electrical Insulation Headquarters

A PARTIAL LIST OF M-R PRODUCTS: FIBERGLAS VARNISHED TUBING, TAPE AND CLOTH • INSULATING PAPERS AND TWINES • CABLE FILLING AND POTHEAD COMPOUNDS • FRICTION TAPE AND SPLICE • TRANSFORMER COMPOUNDS • FIBERGLAS SATURATED SLEEVING • ASBESTOS SLEEVING AND TAPE • VARNISHED CAMBRIC CLOTH AND TAPE • MICA PLATE, TAPE, PAPER, CLOTH, TUBING • FIBERGLAS BRAIDED SLEEVING • COTTON TAPES, WEBBINGS AND SLEEVINGS • IMPREGNATED VARNISH TUBING • INSULATING VARNISHES OF ALL TYPES • EXTRUDED PLASTIC TUBING

This Type MW 3 KW Westinghouse Transmitter covers a range of 2 to 30 megacycles for point-to-point communications

Photo shows two Jennings Vacuum Variable Capacitors in position in final amplifier section of transmitter which is housed in the single cubicle

JENNINGS TYPE U VARIABLE HIGH VOLTAGE CAPACITOR

AD No. 4 OF A SERIES

Another Capacitor Problem Solved—

WIDE RANGE TUNING

Simplified by the use of

JENNINGS TYPE U Capacitor

Other requirements essential for this Type MW Westinghouse Transmitting Unit which Jennings Capacitors helped to solve:

A Capacitor of small physical size. High voltage capabilities. Wide frequency range. High efficiency and long, trouble-free life under all climatic conditions.

The Jennings Flexible Type U Capacitor is used in two capacities, from 60 to 300 mmfds. in the lower frequency ranges and from 10 to 150 mmfds. in the higher frequency ranges.

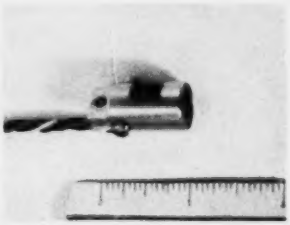
Another problem was solved by using the Jennings Type ATCS neutralizing capacitor in the final stage. This miniature unit has a range of 10 to 120 mmfds. plus the wide safety factor needed in this transmitter.

JENNINGS TYPE ATCS VARIABLE HIGH VOLTAGE NEUTRALIZING CAPACITOR

Write us for information regarding your own Capacitor problem. Literature mailed on request

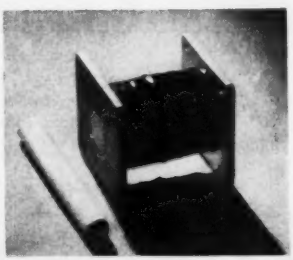
JENNINGS RADIO MANUFACTURING CO. • 970 McLAUGHLIN AVE. • P.O. BOX 1278 • SAN JOSE 8, CAL.

to 1,000 volts and highly polished silver rings to reduce torque friction to an absolute minimum. The rings are rhodium plated to reduce wear and retain their luster and range in diameters from 0.062 to 0.250. These tiny sliprings are highly desirable for gyros, computers, guided missiles, aircraft and many other electronic applications.



Miniature Magnetic Head

COMPUTER RESEARCH CORP., 3348 W. El Segundo Blvd., Hawthorne, Calif. Model HA102 miniature magnetic head was developed to provide higher component density in magnetic memory storage systems. The new head is only $\frac{3}{8}$ in. in diameter and 1 in. long. It operates at frequencies up to 120 kc, having 13.8 mh total inductance and 11 ohms of d-c resistance and is stable over wide temperature ranges. It requires only 50 ma of writing current and produces 0.4 volt of playback voltage from center tap to one end.

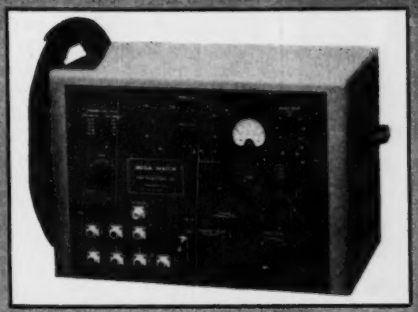


Microwave Switch

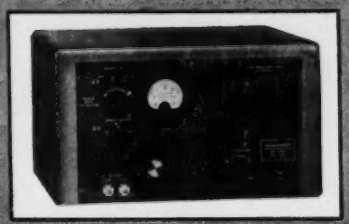
C. H. LUHRS & Co., 297 Hudson St., Hackensack, N. J., has developed a microwave switch for use at X-band. Repeated operation of the

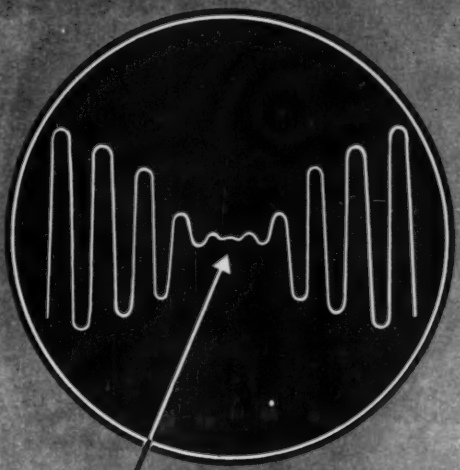
For measurements of line terminations

USE THE MEGA-MATCH—Model UHF



WITH A BUILT-IN MEGA-SWEEP





Envelope is the curve of reflection coefficient vs. frequency over 30 mc. band

TWO INSTRUMENTS IN ONE:—

1. Impedance Match Indicator

Displays: Reflection coefficient vs. frequency over 30 mc. band.

Frequency Range: 10-1000 mcs.

Resolution: One sine wave of beat note:per mc. at low end, per 2.5 mcs. in intermediate range, per 5.0 mcs. at high freqency end.

Sensitivity: Reflection coefficients between 0.01 and 0.1 depending on frequency. Sensitivity can be improved by use of external audio filters and attenuators.

2. Wide Range Sweeping Oscillator

Frequency Range: 50 kcs. to 1000 mcs.

Sweep Widths: At least 30 mc. max.

Sweep Rate: Synchronized to power line but can be operated asynchronously to display amplifier hum.

Output: 100 mv. max. at 50 ohms.

Frequency Measurement: By calibrated coaxial wavemeter.

Available separately as:

The Mega-Sweep . . . $395.00

The Calibrated Mega-Sweep $425.00

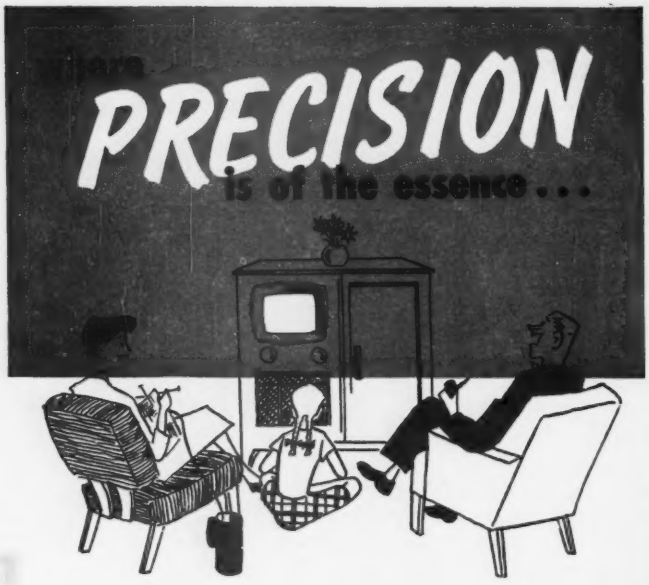
UHF Mega-match complete but without indicator oscilloscope $895.00

F.O.B. factory

KAY

KAY ELECTRIC COMPANY

23 Maple Avenue — Phone CAldwell 6-4000 — Pine Brook, New Jersey



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NATIONAL MOLDITE COMPANY

Samples promptly submitted upon request for design, pre-production, and test purposes

SEND FOR CATALOG 110

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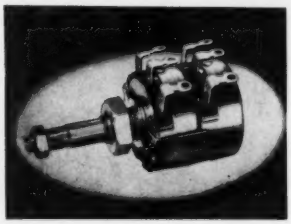
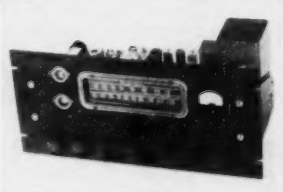
Robert T. Murray, 614 Central Ave., East Orange, N. J.
Jerry Golton Co., 2750 W. North Ave., Chicago 22, Ill.
Martin P. Andrews, Mott Road, Fayetteville, N. Y.
Perlmuth-Colman & Assoc., 1335 South Flower, Los Angeles, Cal.
Jose Luis Pontet, Cardoba 1472, Buenos Aires

switch is accomplished in accordance with the following schedule: (1) With no voltage impressed upon the coil terminals, maximum attenuation is achieved. (2) Voltage is applied to coil terminals to achieve minimum attenuation. (3) Voltage is removed from coil terminals. Attenuation does not rise to the fully maximum value until a small reversed voltage is applied; the maximum attenuation figure is then again realized. Weight of the switch is 6 oz; length, 1⅞ in.; maximum attenuation, 40 db; minimum attenuation, 1 db; d-c power required for operation, 6 watts.



Dual-Concentric Control

CLAROSTAT MFG. CO., INC., Dover, N. H. Adaptation of a proven design for locking shafts at a desired setting is now available on a dual-concentric control. Use of this construction will allow the replacement of two panel units requiring locked semipermanent settings. It is a dual-concentric unit where concentric operating shafts and tapered jam nuts are used for locking the individual controls at any desired settings. This type control requires one-half the panel space of two single units.

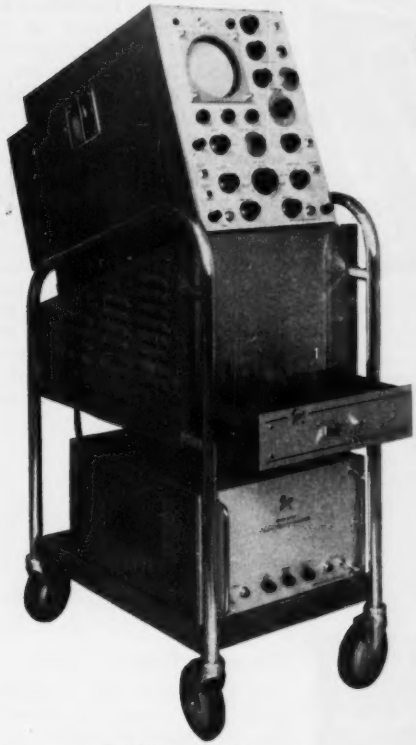


F-M/A-M Tuner

COLLINS AUDIO PRODUCTS CO., P. O. Box 368, Westfield, N. J. Type 45-S

PERFORMANCE + STABILITY

TYPE 517 OSCILLOSCOPE



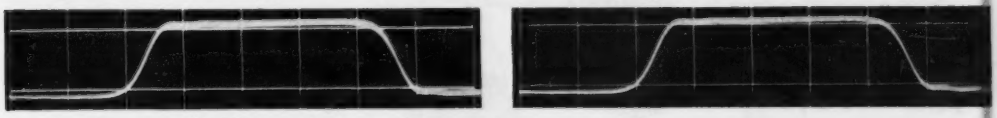
TEKTRONIX TYPE 517

***RISETIME*—.007 usec, or less (10%-90%)**
***SWEEP RANGE*—.01 usec/cm to 20 usec/cm**
***SENSITIVITY*—.1 v/cm**
***ACCELERATING POTENTIAL*—24kv**

The Tektronix Type 517 Cathode Ray Oscilloscope has been enthusiastically accepted by research and development laboratories throughout the country. A partial explanation of this response can be given in terms of the remarkable operational stability of this instrument.

In order that usable, meaningful information can be obtained in the range of operation of the TYPE 517, it is necessary that a high degree of stability be designed into the circuits.

As an illustration, the photographs reproduced below show a .045 usec pulse, initial rise time .001 usec, recurring at a rate of 5cps. The sweep is being triggered by each pulse, and is operating at a rate of 0.01 usec/cm. The photograph on the left is a continuous exposure over a twelve hour period during which the line voltage varied between 115v and 125v. The photograph on the right is a five minute exposure taken immediately after the long exposure.



Factors contributing to the excellent performance and stability of the Type 517 are:

Use of highest quality components.
Electronic regulation of indicator heaters, CRT gun voltage, and other critical voltages against both load and line changes.
Five stages of distributed vertical amplification.
A triggered, hard-tube bootstrap-type sweep circuit.
Adequate forced ventilation of both indicator and power supply units.

TEKTRONIX TYPE 517 CATHODE RAY OSCILLOSCOPE, $3500 F.O.B. Portland, Oregon

TEKTRONIX, Inc. P. O. Box 831, Portland 7, Oregon
ATwater 6357 Cables: Tektronix

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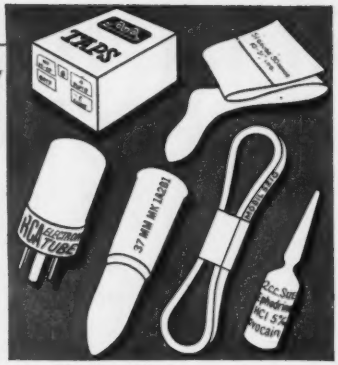
marks them all
FROM ARTILLERY SHELLS TO MEDICAL AMPULES



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Markem methods, machines, type and inks have been marking the products of industry for forty years. Markem machines can mark up to many thousands of pieces per hour. They make clear, durable imprints on flat, curved or irregular surfaces of paint, paper, wood, glass, metal, leather, plastic, rubber, fabric, composition and pressure sensitive tapes. No special skill is needed for their operation. Legend and color of imprint may be quickly and easily changed.

MAKE YOUR MARK WITH MARKEM

When your products need marking for Identification, Control or Market — ask Markem. Submit your problem, together with a sample of the item to be marked. Markem Machine Company, Keene 5, New Hampshire.

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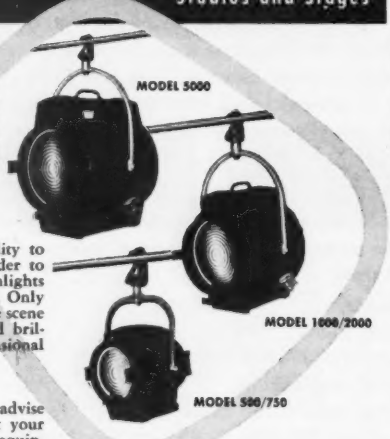
BETTER MARKING SINCE 1911

Bardwell & McAlister's Line of Television Lights

TV SPOTS • Designed for Television Studios and Stages

Drawing upon their sixteen years of experience in the production of studio lights used by the motion picture industry, Bardwell & McAlister, Inc. now offers a complete new line of lights especially designed and engineered for TV stage and studio lighting.



Paint with Light

Painting with light is the ability to control the light source, in order to emphasize the necessary highlights and the all-important shadows. Only through controlled light can the scene or subject be given the desired brilliance, beauty and third dimensional effects.

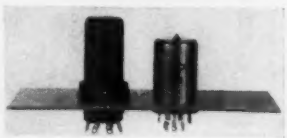
Our Specialists...

are always ready to assist and advise your engineering staff, so that your studios and stages will be fully equipped to properly "Paint with Light."

Write for complete specifications and prices of these TV SPOTS. Address Dept. 68.

BARDWELL & McALISTER 2950 ONTARIO STREET BURBANK, CALIFORNIA

f-m/a-m tuner has available two output impedances: 500 ohms through an output transformer and high impedance directly off the plate of the 6J5 through a coupling capacitor. The tuner also has an f-m squelch available. When higher sensitivity is required the squelch may be switched out allowing full sensitivity of between 5 and 10 μv. Electrical characteristics are as follows: power source, 110 v a-c, 60 cycles; power consumption, 125 w; f-m sensitivity, 10 μv average; a-m sensitivity, 80 μv average; i-f bandwidth (f-m), 150 kc; image ratio (f-m), 1,500 to 1; i-f (f-m), 10.7 mc; antenna input, 300 ohms; frequency response of audio, 50 to 15 kc plus tone control variation of 10 db up or down. Price of the unit is $295.50.

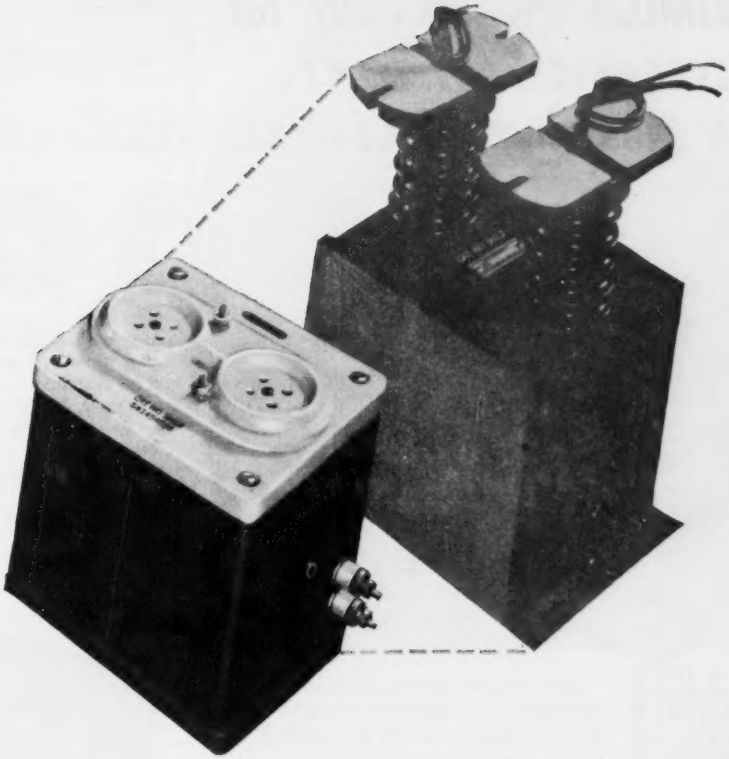


Miniature Relay

THE HART MFG. CO., Hartford, Conn. The Diamond-H aircraft-type hermetically sealed miniature relays are 4-pole double-throw units that are designed to meet the requirements of USAF specification MIL-R-5757 and exceed several standard requirements by significant margins. The relays give operational shock resistance in excess of 50 g, and will not drop out until voltages of 7 or less are reached. Designed for operation in temperatures ranging from −65 C to +200 C, they have given satisfactory test results over a much wider span. Transit time is approximately one millisecond. Insulation resistance is in excess of 500 megohms. Contact ratings are 2 amperes, 28 v, d-c; 2 amperes, 115 v a-c including 400 cycle; inductive, noninductive and motor loading.

Synchroscope

BROWNING LABORATORIES, INC., 750 Main St., Winchester, Mass. Model



Making little ones out of big ones . . .

Many a design problem has been simplified by the Westinghouse ability to reduce transformer size and weight.

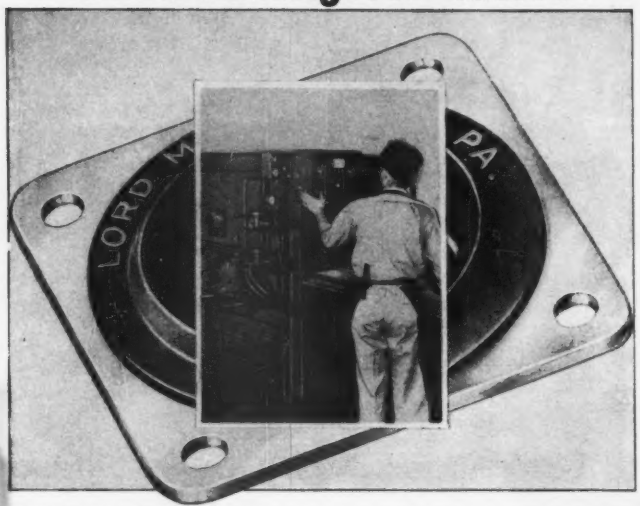
Here, for example, is a case where a transformer was required to work in a voltage-doubler circuit at 18,000 volts. The old model created a space problem.

First step in redesigning, Westinghouse engineers applied a smaller, lighter Hipersil® Core. That, plus improved insulation, made it possible to reduce coil size and spacing. Then a wet-process porcelain cap, with integral tube sockets, eliminated the need for stand-off insulators. The net result was an over-all reduction of 30% in both size and weight of the completed power unit . . . with a great big bonus: The saving to the equipment assembler in installation costs alone made the new design highly profitable, because it was no longer necessary to wire tube sockets.

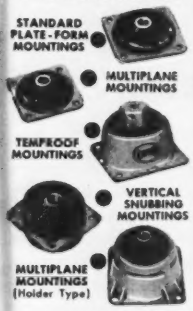
Savings like this are available to you, too. If size, weight, performance, or quantity production have any bearing on your transformer problem, call your Westinghouse representative, or write Westinghouse Electric Corporation, Specialty Transformer Department, Sharon, Pennsylvania. J-70610

YOU CAN BE SURE... IF IT'S
Westinghouse
TRANSFORMERS

MAXIMUM PROTECTION for ELECTRONIC EQUIPMENT. Lord Mountings, of Course!



HERE ARE A FEW LORD MOUNTINGS DESIGNED FOR ELECTRONIC INSTALLATION



Lord engineers are best prepared to mount your electronic equipment correctly. They have developed thousands of mountings for specific conditions to deliver maximum protection against shock and vibration.

You can draw from this reservoir of proved mountings with greatest economy and speed.

However, if your electronic equipment demands a specially designed mounting, Lord engineers will work with you to develop the most efficient and economical mounting you can buy.

Take advantage of Lord Engineering "know-how" and modern production facilities.

For immediate consultation call or write—

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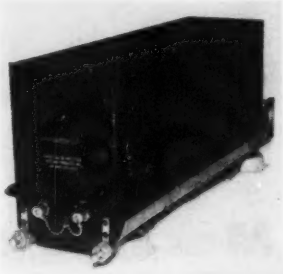
HEADQUARTERS FOR
VIBRATION CONTROL MOUNTINGS
. . . BONDED RUBBER PARTS

P4-EX synchroscope is designed for those applications requiring a triggered sweep. An internal trigger generator with continuous adjustment from 50 to 5,000 pps enables the scope to be used as a timing source. The triggered sweep is continuously variable and calibrated from 1.0 μsec per in. to 25,000 μsec per in. Output triggers may be phased from 500 μsec before the sweep to 500 μsec following the start of the sweep. A vertical amplifier with a flat response from 5 cycles to 5 mc makes the unit useful for examination of various pulse waveforms. The P4-EX uses a 5-in. c-r tube and is housed in a compact steel cabinet 14½ in. high, 10 in. wide and 16¾ in. deep. Weight is 50 lb.



Airborne Audio Amplifiers

GERTSCH PRODUCTS, INC., Los Angeles, Calif., has started production on its airborne audio amplifiers models AA-1A and AA-1B. The assembly includes ½ ATR rack with shock mount and has 20 watts output with controlled response. The amplifiers were developed primarily for p-a and entertainment use aboard aircraft. Both models include variable frequency response by means of a 4-position filter (for noise suppression); remotely operated level control; and dual input circuits. Model 1A weighs 20 lb and No. 1B, 23 lb. Distortion is less than 5 percent at 20 w; input level, zero db across 600 ohms, 1 mw; input impedance, 600 ohms. Input circuits are (a) 600-ohm line and (b) 600-ohm carbon microphone

TOP PERFORMANCE 7000 MCS

and every other microwave frequency

The WORKSHOP was the first manufacturer to bring out a complete line of parabolic antennas. Today these antennas are recognized as the *top performers* for all microwave frequencies. This is the result of years of specialization on all types of high-frequency antennas in laboratories with the finest research and test equipment. Normally, we can meet your requirements with our standard equipment but for special applications, reflectors can be supplied in a wide range of sizes and focal lengths.

Series 7000 Includes Models 6075, 6725 and 7275

	Model 6075			Model 6725			Model 7275		
Frequency Range	5925 to 6175 Mcs.			6525 to 6875 Mcs.			7125 to 7425 Mcs.		
Reflector Size	48″	72″	96″	48″	72″	96″	48″	72″	96″
Gain (db, approx., over isotropic radiator)	34.4	37.5	40.4	35.0	38.5	40.8	36.0	39.4	42.0
Half Power Angles (H plane)	2.86°	1.92°	1.32°	2.50°	1.74°	1.32°	2.42°	1.61°	1.21°
(E plane)	3.24°	2.04°	1.47°	2.79°	1.94°	1.47°	2.70°	1.81°	1.36°

Input Impedance	52 ohms nominal
VSWR	1.3 to 1 or better
Power Rating	1 kw. continuous
Polarization	Either vertical or horizontal available at time of installation.
Side Lobes	25 db down or better
Input Connection	UG-343/U choke flange fitting for RG-50/U (¾″ x 1½″) pressurized waveguide. Standard fitting. Special feeds and fittings on special orders only.
Dish and Feed Heaters	Available for all models. The dish heater capacities range from 400 to 4000 watts. The feed heater draws 20 watts.

OTHER STANDARD MODELS

MODEL NO.	FREQUENCY (MCS.)	GAIN* (DB.)	HALF POWER ANGLE E Plane*	H Plane*
940	920-940	19.0-28.0	19.75°-7.8°	17.75°-6.9°
2000	1700-2300	27.0-34.5	10.28°-3.65°	9.2° -3.25°

*Gain and Half Power Angles are dependant on size and frequency of parabolas, — 4, 6, 8 or 10 foot diameter.

Write for Parabolic Antenna Catalog

THE WORKSHOP ASSOCIATES

DIVISION OF THE GABRIEL COMPANY

Specialists in High-Frequency Antennas

135 Crescent Road, Needham Heights 94, Massachusetts

FREE SLIDE RULE—This pocket size slide rule quickly computes diameter, wavelength, angle and gain for parabolic antennas. Reverse side carries FCC frequency allocations, conversion tables and other data. Write for your copy.

ARROW HAS THEM IN STOCK!

JAN-C-25 CAPACITORS

Here's good news to all JAN users. ARROW has in stock at all times the hard-to-get JAN-C-25 Specifications Capacitors. Listed below are some of the most sought after numbers. These are products of leading manufacturers, all current production, with JAN numbers stamped on the capacitors themselves and on their cartons. Certificates of Compliance are available on request.

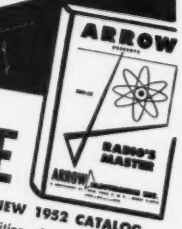
JAN Number	Each
CP27A1EF103V	.67
CP27A17F104M	.88
CP27A1EF203M	.75
CP27A1EF254M	1.18
CP27A1EF503M	.91
CP27A1EF504M	1.51
CP27A1EF602M	.67
CP27A1EF103V	.88
CP28A1EF104M	1.11
CP28A1EF203M	.97
CP28A1EF254M	1.41
CP28A1EF503M	1.02
CP28A1EF504M	1.72
CP28A1EF602M	.88
CP28A1EF103V	.87
CP29A1EF104M	1.08
CP29A1EF203M	.99
CP29A1EF254M	1.38
CP29A1EF503M	1.00
CP29A1EF504M	1.70
CP29A1EF602M	.87
CP29A1EM405V	3.99
CP53B1EF104V	1.73
CP53B1EF105V	2.24
CP53B1EF205V	2.97
CP53B1EF254V	1.83
CP53B1EF503V	1.72
CP53B1EF504V	1.96
CP53B4EF104V	2.22
CP53B4EF105V	3.16
CP53B4EF254V	2.24
CP53B4EF503V	2.16
CP53B4EF504V	2.56
CP53B5EF104V	2.49
CP53B5EF254V	2.83
CP53B5EF503V	2.26
CP53B5EF504V	3.43
CP54B1EF104V	1.75
CP54B1EF105V	2.24
CP54B1EF205V	2.97
CP54B1EF254V	1.93
CP54B1EF503V	1.72
CP54B1EF504V	1.96
CP54B4EF104V	2.23
CP54B4EF254V	2.24
CP54B4EF504V	2.56
CP54B5EF104V	2.49
CP54B5EF254V	2.83
CP54B5EF504V	3.43
CP55B1EF104V	1.73
CP55B1EF105V	2.24
CP55B1EF205V	2.97
CP55B1EF254V	2.24
CP55B1EF503V	1.72
CP55B1EF504V	1.96
CP55B4EF104V	2.22
CP55B4EF254V	2.23
CP55B4EF504V	2.56
CP55B5EF104V	2.49
CP55B5EF254V	2.83
CP55B5EF504V	3.43
CP55B5EF104V	2.37
CP55B5EF254V	3.04
CP61B1EF104V	2.53
CP61B1EF105V	2.23
CP61B1EF254V	2.70
CP61B1EF503V	2.97
CP61B1EF504V	3.04
CP61B4EF104V	3.51
CP61B4EF254V	2.46
CP61B4EF504V	3.13
CP63B1EF104V	2.62
CP63B1EF105V	2.79
CP63B1EF254V	3.04
CP63B1EF504V	3.13
CP63B4EF104V	3.58
CP63B4EF254V	2.46
CP63B4EF504V	3.13
CP63B6EF104V	2.62
CP63B6EF254V	2.79
CP63B6EF504V	3.04
CP65B1EF104V	3.13
CP65B1EF105V	3.58
CP65B1EF254V	2.62
CP65B1EF504V	2.79
CP65B4EF104V	3.04
CP65B4EF254V	3.13
CP65B4EF504V	3.58
CP65B6EF104V	2.13
CP65B6EF254V	2.79
CP65B6EF504V	2.29
CP67B1EF104V	2.46
CP67B1EF105V	2.79
CP67B1EF254V	2.79
CP67B1EF504V	3.27
CP67B4EF104V	3.27
CP67B4EF254V	2.13
CP67B4EF504V	2.79
CP67B5EF104V	3.45
CP67B5EF254V	2.29
CP67B5EF504V	2.46
CP69B1EF104V	2.79
CP69B1EF105V	3.27
CP69B1EF254V	3.27
CP69B1EF504V	3.45
CP69B4EF104V	.54
CP69B4EF254V	.54
CP69B4EF504V	.54
CP69B5EF104V	.54
CP69B5EF254V	.54
CP06FA1	.54
CP06FA2	.54
CP06FA3	.54
CP06FA4	.54
CP06FA5	.54
CP06SA1	
CP06SA2	

FREE CENTRALAB'S COLOR CODE WALL CHART

We'll be happy to send you a copy of this valuable, big, 3 feet by 3 feet, color code wall chart. Illustrates over 3000 separate color code markings on all JAN-type and RMA components. You'll find it as indispensable as your slide-rule. Requests by authorized personnel on company letterheads will bring you this color code wall chart FREE.

FREE ARROW'S BIG NEW 1952 CATALOG

Get this big new edition of Radio's Greatest Catalog. Over 1,000 pages of Everything in Electronics, Radio, TV, Equipment, etc. Requests by authorized personnel on company letterheads will bring you this valuable new catalog FREE.



ARROW ELECTRONICS INC.

82 CORTLANDT ST., NEW YORK 7, N. Y. • DIGBY 9-4714

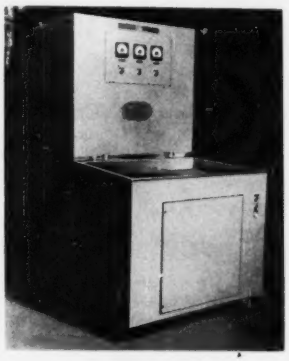
For Super Speed: TELETYPE NY-1-472

Direct Western Union Wire: ARROW ELECTRONICS - WUX - N. Y.

with filtered current supply; output impedance is 50-100-500 ohms.

TV Picture Tubes

ALLEN B. DUMONT LABORATORIES, INC., Clifton, N. J., has available two new all-glass 21-in. rectangular tv picture tubes. Both employ a bulb that results in a picture area of 242 sq in., with screen face made of filter-glass for minimizing reflections and improving contrast. Type 21EP4A employs the bent gun for electromagnetic focusing. A single-magnet ion trap is used. Type 21KP4A is one of the Selfocus Tele-trons requiring no focus controls or circuitry. It provides absolute focus at all times. The latter type may be used as a replacement for either elect magnetic or electrostatic foc type tubes.

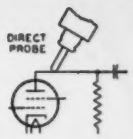


Induction Heater

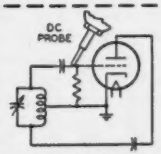
GENERAL ELECTRIC CO., Schenectady 5, N. Y., has announced an improved 20-kw induction heater featuring a nonventilated, dust-proof NEMA type 12 enclosure, and designed for use in high-speed annealing, brazing, hardening and soldering. Type HM-20L1 heater, for short-run production of a wide variety of parts, has variable power adjustment from 0 to 100 percent by means of a rheostat. For long-run, higher-production applications that do not have rapid cycling, type HM-20L2 heater (without variable power adjustment) is recommended. Units are available for operation on 230, 460, or 550-volt,

Now ...a NEW Junior VoltOhmyst* ...the WV-77A

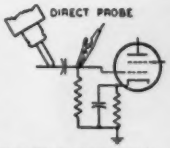
For all regular measurements and specialized measurements as illustrated.



MEASURES AC VOLTS . . . such as signal voltage on plate of rf tube.



MEASURES DC VOLTS . . . such as oscillator grid bias. One-megohm resistor in probe prevents circuit loading.



MEASURES RESISTANCE . . . such as leakage in coupling capacitor up to 1000 megohms.

Just one probe cable and one slip-on probe handle all measurements.

Check these important features . . .

- ✓ Accurate laboratory calibration.
- ✓ Meter electronically protected against burn-out.
- ✓ Metal case shielding . . . extra stability in rf fields.
- ✓ Sturdy 200-microampere meter movement.
- ✓ Carbon-film 1% multiplier resistors . . . dependability plus.
- ✓ Zero-center scale . . . for discriminator alignment.
- ✓ Frequency response flat from 30 cps to approximately 3 Mc.
- ✓ High ac input resistance for greater accuracy.
- ✓ Constant dc input resistance . . . 11 megohms on all scales.
- ✓ Negative feedback circuits for greater over-all stability.
- ✓ Ohms cable always positive . . . for quick leakage measurements of electrolytic capacitors.
- ✓ Polarity reverse switch . . . eliminates cable switching.
- ✓ ±3% over-all accuracy on +dc scales, and ±5% on ac and −dc scales.

Available from your RCA Test Equipment Distributor

An all-electronic ac-operated vacuum-tube volt-ohmmeter by RCA

ONLY $47.50.

Includes DC probe, AC direct probe and cable, ground lead, and alligator clip.

The RCA WV-77A VoltOhmyst* provides the extra features you have tried to find in an inexpensive VTVM. Using the famous VoltOhmyst electronic bridge circuit, 200-microampere meter movement, and carbon-film multiplier resistors, the WV-77A incorporates features you would expect to find only in more expensive instruments. Sturdily built . . . calibrated against laboratory standards . . . and backed by a 12-month warranty . . . the WV-77A has the durability, versatility, and accuracy to please discriminating customers such as service technicians, engineers, amateurs, and military personnel.

As a DC Voltmeter it measures dc from 0.05 volt to 1200 volts in five ranges. Uses 1-megohm resistor in isolating probe; probe has less than 2-uuf input capacitance. Has 11-megohm input; useful for measuring high-resistance circuits such as oscillator, discriminator, and avc.

As an AC Voltmeter it measures ac from 0.1 volt to 1200 volts rms in five ranges. Uses high-impedance diode tube as signal rectifier. Frequency range is more than adequate for measurement of power line, audio, and ultra-sonic frequencies.

As a wide-range Ohmmeter the WV-77A measures resistance from 0.2 ohm to 1 billion ohms in five ranges. Requires only 1.5-volt battery as burn-out protection in measuring such low-power elements as battery-type tube filaments.

The all-new RCA WV-77A VoltOhmyst comes completely equipped with probes and cables as illustrated. For complete details, see your RCA Test Equipment Distributor today . . . or write to RCA, Commercial Engineering, Section 42AX, Harrison, N. J.

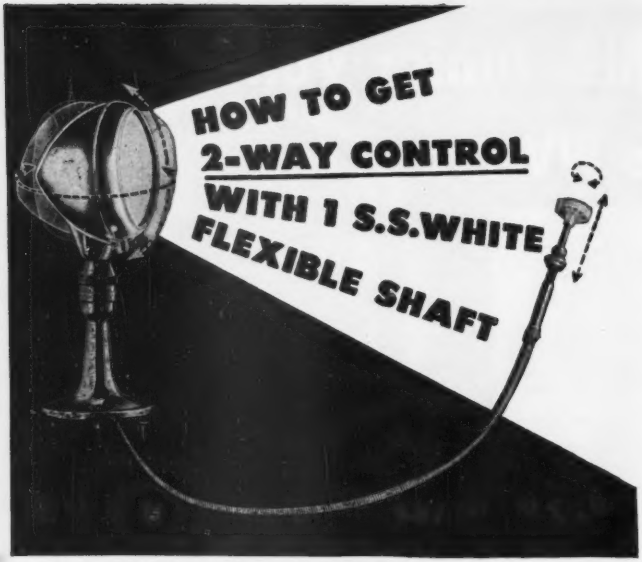
Accessories Available on Order

The WG-289 High-Voltage Probe and WG-206 Multiplier Resistor extend the dc range of the WV-77A to 50,000 volts.

The WG-264 Crystal-Diode Probe extends frequency range of the WV-77A to 250 Mc.

*Reg. U. S. Pat. Off.

RCA **RADIO CORPORATION of AMERICA**
TEST EQUIPMENT HARRISON, N. J.



Courtesy Arnolt Co., Warsaw, Ind.

HERE'S an "on-the-spot" answer to the problem of providing equipment with a combination of push-pull and rotary control. As the illustration shows, with only a single S.S.White flexible shaft, the light can be swung the full 360° arc and tilted up or down simply by turning the control knob or by pushing it in or pulling it out.

The same idea can be used on a wide variety of electronic equipment containing parts which must be regulated from more or less remote points. Not only do S.S.White flexible shafts offer considerable advantages in terms of simplicity and economy, but they also give more freedom in locating the coupled parts where desired.

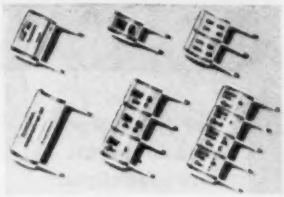
SEND FOR THIS FREE BULLETIN

Bulletin 5008 has essential facts and data on flexible shafts and shows how to select and apply them.

THE S.S.White INDUSTRIAL DIVISION
DENTAL MFG. CO.
Dept. E, 10 East 40th St.
NEW YORK 16, N. Y.

Western District Office • Times Building, Long Beach, California

three-phase, 60-cycle power supply. Weight is approximately 3,600 lb.

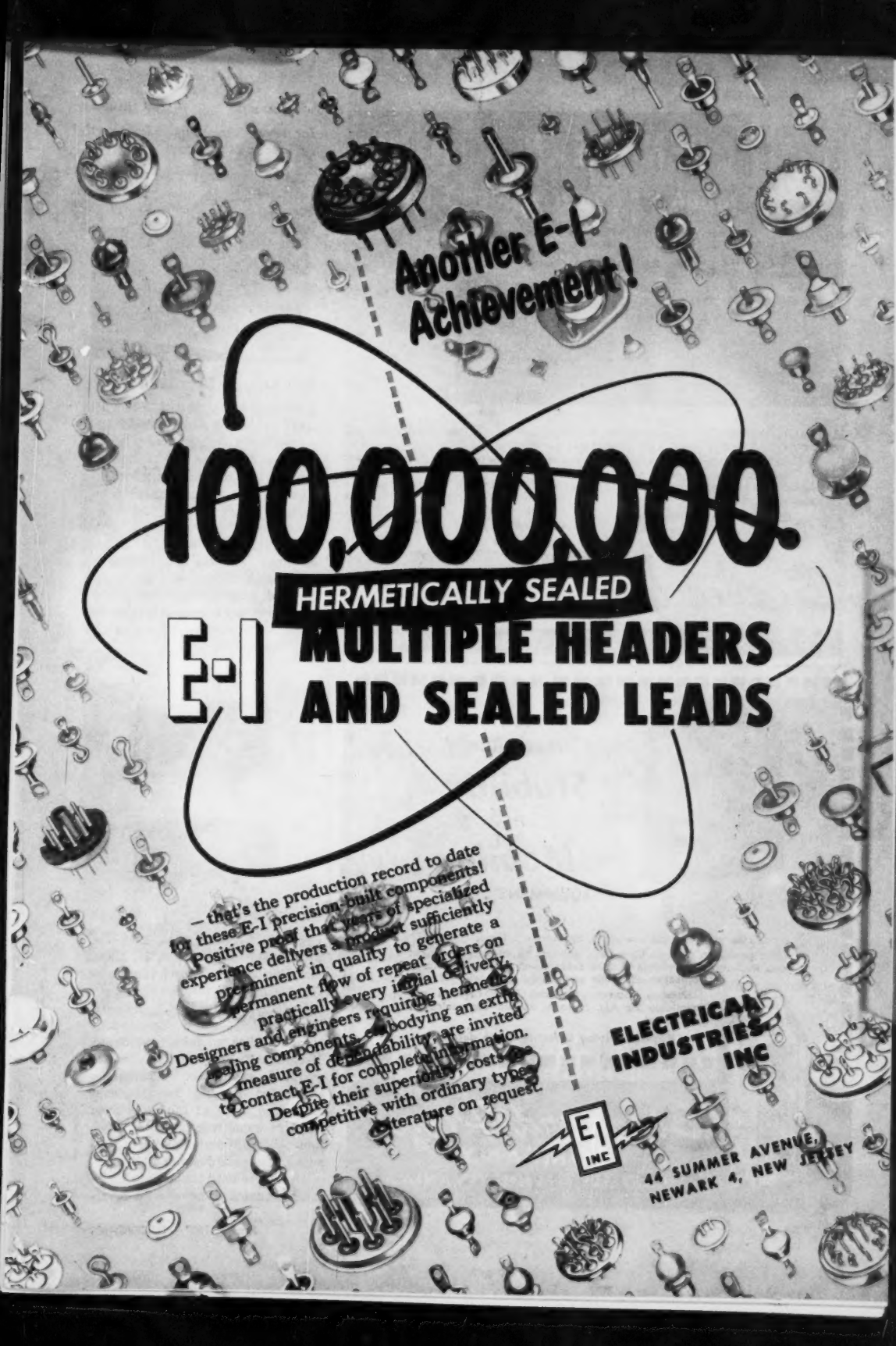


Resistors

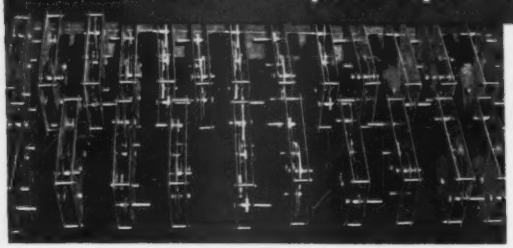
CINEMA ENGINEERING CO., Burbank, Calif., has added BW resistors to its resistor line. The entire series is provided with soldered lugs and have entire range sizes from single section chapron-wound to a 4-section resistor and multi-pi winding in the larger BW-1B type. Resistance values are 1 ohm to 1 megohm. Wattage rating varies from 0.25 to 1 watt. They are available in a variety of resistance wire alloys and impregnation treatments.

Oscilloscynchroscopes

BROWNING LABORATORIES, INC., 750 Main St., Winchester, Mass., announces models ON-5A and ON-5X oscillosynchroscopes, each featuring a sweep system that may be operated in either triggered or recurrent fashion with direct-reading panel calibrations of sweep speed. Sweep writing rates are continuously variable from 1.0 μsec per in. to 25,000 μsec per in. Vertical amplifiers are flat within ±3 db from 5 cycles to 5 mc. Horizontal bandwidth is from d-c to 500 kc. A vertical deflection calibration source of 0 to 2, 0 to 20 and 0 to 200 volts provides a convenient means


Another E-I Achievement!
100,000,000
HERMETICALLY SEALED
E-I MULTIPLE HEADERS AND SEALED LEADS
—that's the production record to date for these E-I precision-built components! Positive proof that years of specialized experience delivers a product sufficiently pre-eminent in quality to generate a permanent flow of repeat orders on practically every initial delivery. Designers and engineers requiring hermetic sealing components, embodying an extra measure of dependability, are invited to contact E-I for complete information. Despite their superiority, costs are competitive with ordinary types. Literature on request.
ELECTRICAL INDUSTRIES INC
E I INC
44 SUMMER AVENUE, NEWARK 4, NEW JERSEY

small OPEN GEAR TRAINS
made to your specifications



Many units, such as timers, transmitters, vending mechanisms, and similar devices require the adoption of small open gear trains for intermittent duty.

Beaver Gear Works is equipped to make these trains to any degree of accuracy required. Beaver Gear engineers, knowing what is expected, and qualified to assist in details of fine-pitch gear applications, can advise you as to what will work best under various conditions and can specify the correct design.

MEMBER OF AGMA

Consult us on your gear problems.

Beaver Gear Works Inc.

1021 PARMELE STREET, ROCKFORD, ILLINOIS

FOR FREQUENCY
Stability
IN
Mobile
EQUIPMENT . . . .

make sure your crystals are made by Standard Piezo.

For years, our Crystals have been standard as original equipment with leading manufacturers and for replacement purposes by large operators of mobile equipment.

Precise, accurate, Standard Piezo Crystals are available for *ALL* types of mobile communication equipment.

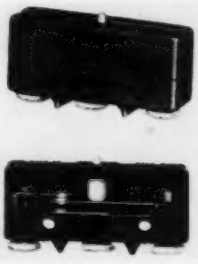
Request catalog E for complete details.

Standard Piezo
COMPANY
CARLISLE, PENNSYLVANIA

for determining amplitude of vertical input voltages.

A-C Voltage Regulator

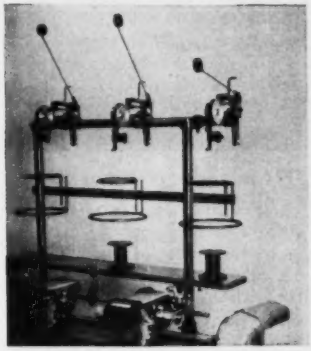
SORENSEN & Co., INC., 375 Fairfield Ave., Stamford, Conn., Model 1001 a-c voltage regulator has a regulation accuracy of ±0.01 percent. Input is 95 to 130 v a-c, single phase, 55-65 cycles; output voltage is adjustable from 110 to 120 v a-c. Accuracy is guaranteed at room temperature, for a resistive load, an input variation of ±10 percent, and over a two-to-one load change. The unit contains only four vacuum tubes and no relays. All tube filament voltages are regulated for long dependable life.



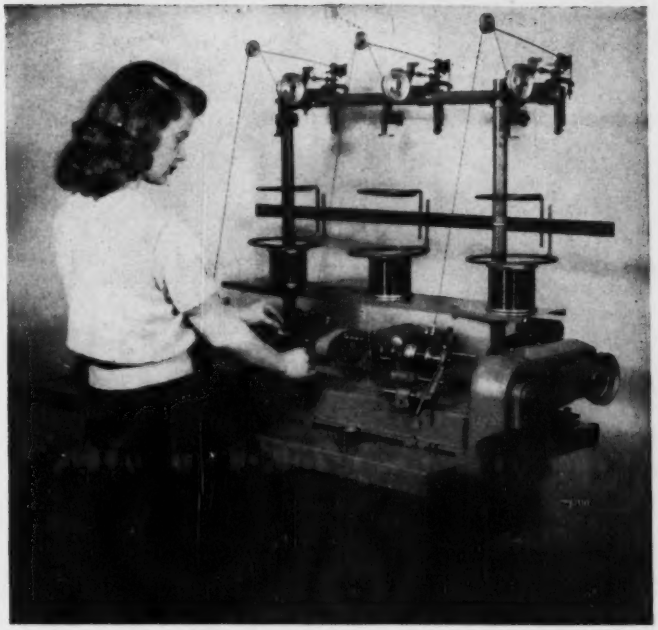
Limit Switch

GENERAL CONTROL CO., 1202 Soldiers Field Road, Boston 34, Mass., has developed the switch illustrated for use in applications requiring a compact, lightweight, long-life limit switch. As a direct-acting switch it has no inherent bounce. Mechanical lost motion, which would delay contact operation, is eliminated because instantaneous contact is made at the same fixed point of repetitive plunger travel. The centrally-located plunger permits easier cam design and acts directly on the long contact spring to insure contact transfer with maxi-

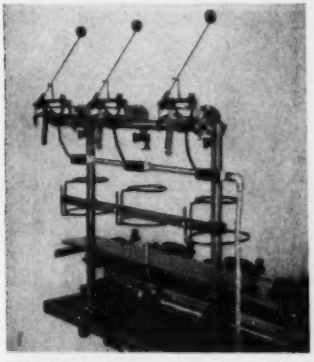
NON-INSULATED COILS WOUND AT 5000 RPM



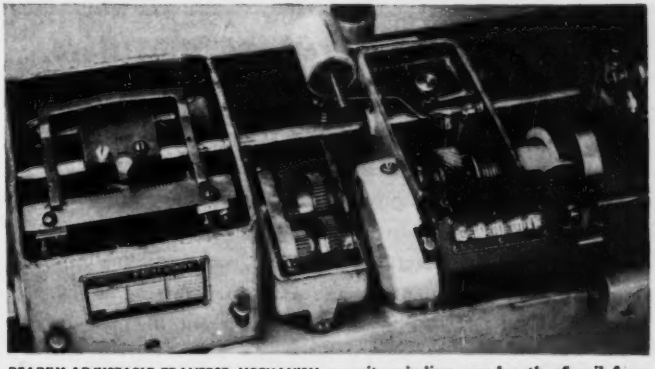
WINDING STARTS INSTANTLY WITHOUT DANGER OF WIRE BREAKAGE with the overend tension. The first turn can be started tightly against the spool or bobbin head, improving "lay".



WHEN OPERATOR FINISHES manual procedure on one head, another coil will have just been completed. By synchronizing winding and handling time on the No. 102 Universal Hi-Speed Coil Winder, you get maximum production per operator. Coils up to 15,000 turns can as a rule be handled efficiently on a 3-head machine at a maximum of 5000 rpm.



WIRE BREAKAGE DETECTOR is optional equipment for stopping arbor promptly when wire breaks or runs out. This relieves operator of having to watch wire spool continually and prevents counting of turns when wire is not being wound.

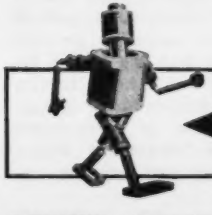


READILY-ADJUSTABLE TRAVERSE MECHANISM permits winding any length of coil from 1/16 in. to 2 13/16 in. without changing cams. A single setting applies to all the winding heads.

Write for Bulletin 102-H

UNIVERSAL WINDING COMPANY

P. O. Box 1605, Providence 1, R. I.



LEESONA

For winding coils in quantity accurately . . . automatically use Universal Winding Machines

238.1.1

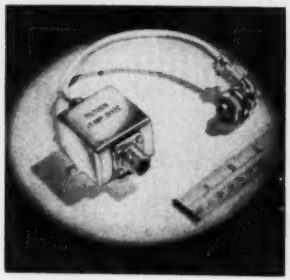
Many Industrial Products Start Here

Mosinee "fibres that work for industry" depend upon a reforestation program which not only assures trees for the future but protects our forests today. Mosinee Industrial Forests, augmented by aid in planting waste land, make raw material supply secure and ever-growing. From seedlings to technically controlled papers, MOSINEE safeguards every step in the process of making Mosinee Fibres that work for industry.

MOSINEE PAPER MILLS CO., Mosinee, Wis.

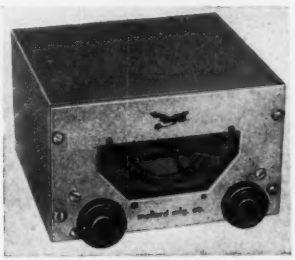
MOSINEE
makes fibres work for industry

mum spring pressure. Contact arrangement is spdt, spring return. It will handle up to 20 amperes, 125 volts a-c, noninductive.



R-F Interference Filter

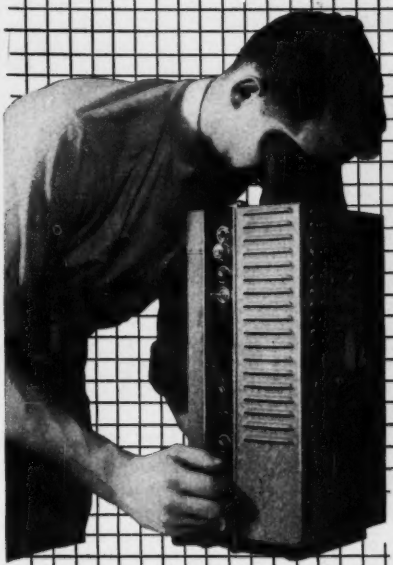
THE FILTRON CO., INC., 131-05 Fowler St., Flushing, N. Y., announces production of a new 15-ampere, 28-volt d-c, r-f interference filter. The unit is hermetically sealed, with AN connectors, and features high attenuation from 150 kc to 400 mc. It is specially designed for aircraft applications.



Mobile Converters

MALLARD MFG. CO., 6025 North Keystone Ave., Chicago 30, Ill. Types 10N, 20N and 75N converters, providing improved mobile operation on the amateur bands indicated by the model numbers, utilize 6AB4 oscillators which function efficiently even with low battery voltages common during subfreezing temperature periods. Model 10-20 converter provides operation on both the 10 and 20-meter bands and is available with or without built-in noise limiter. Band switching is accomplished with a new two-position sliding switch board that permits ex-

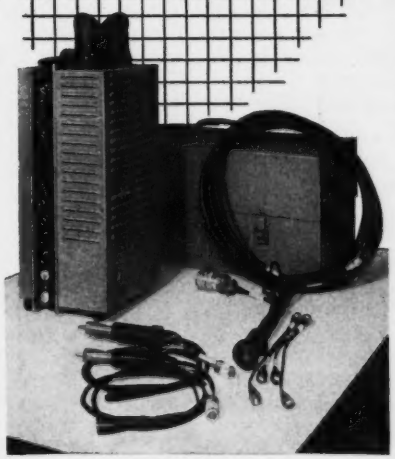
A compact, lightweight, wideband oscillograph...



the DU MONT Type 334-A for...

- **field maintenance of microwave, radar, and pulsed systems.**
- **setting up relay links, transmission line terminations, mobile communication systems, etc.**
- **testing airborne equipment, as well as testing mobile ground equipment.**
- **trouble-shooting and maintaining electronic computers, television, telemetering, and associated circuits.**

Price $750



The Du Mont Type 334-A is a small, highly portable, wideband oscillograph intended for general field engineering and maintenance.

•

Utilizes Type 2AP1-A cathode-ray tube with a magnifier, and calibrated scale with variable illumination. Produces a trace of high resolution.

•

Both driven and recurrent sweeps are provided in three ranges from 50 to 50,000 cycles per second for recurrent sweeps, and from 280 to 5 μ seconds duration for driven sweeps.

•

Inputs include a high-impedance input with three attenuator positions; a low-impedance position; and a ½-μ second delay line terminated by a 10-step attenuator with a total of 20 db attenuation in 2 db steps, plus a fine gain control. Deflection factor of vertical amplifier at full gain is 0.3 p-p volt/inch with frequency response of amplifier within 30% from 40 cycles to 2.5 MC. Pulse response, 0.14 μ second.

•

Weight: less than 30 lbs. Overall dimensions (including eyeshade): only 8" x 9" x 21". Operates from power source of 115 ± 10 volts at any frequency between 50 and 1200 cycles per second.

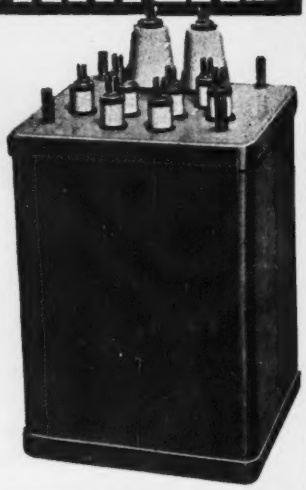
•

In addition to sturdy metal carrying case, Type 334-A is supplied with two probe assemblies, two 10-foot coaxial patching cords, and 15-foot power cord.

ALLEN B. DU MONT LABORATORIES, INC., INSTRUMENT DIVISION • CLIFTON, N.J.

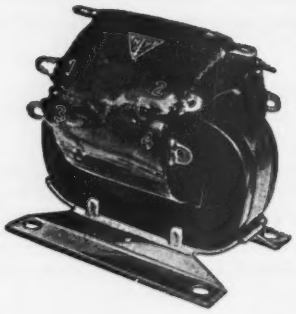
FULL RANGE OF MIL-T-27 TRANSFORMERS

HERMETICALLY SEALED UNITS



NYT hermetically sealed transformers are available in all standard sizes to meet MIL-T-27 specifications, and especially designed constructions for a wide variety of military as well as civilian applications. Designed and built to meet the most exacting specifications. Production facilities for quantity production of all sizes.

the HORNET



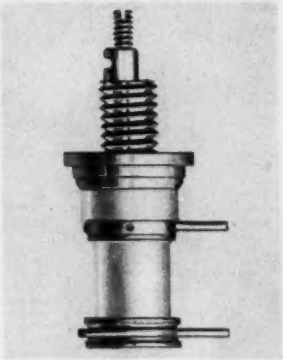
HORNET transformers, pioneered by NYT, are of open type construction, utilizing Class H insulating materials. Approximately one-fourth the size and weight of comparable Class A units. Filament and plate supply transformers and chokes. Units can be designed for ambients up to 190 deg. C., altitudes up to 60,000 feet; power ratings from 2VA to 5KVA.

POWER, AUDIO, FILAMENT and PLATE TRANSFORMERS
REACTORS • FILTERS • CHOKES
TV • RADIO • ELECTRONICS

Engineering and development facilities

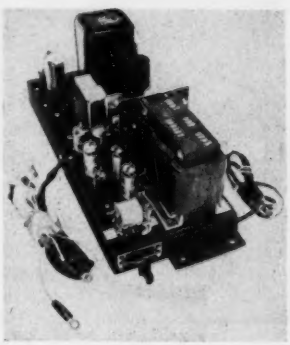
NEW YORK TRANSFORMER CO., INC.
ALPHA, NEW JERSEY

tremely short leads, thus assuring high efficiency for two-band operation. Descriptive literature is available.



Slug-Tuned Coil Form

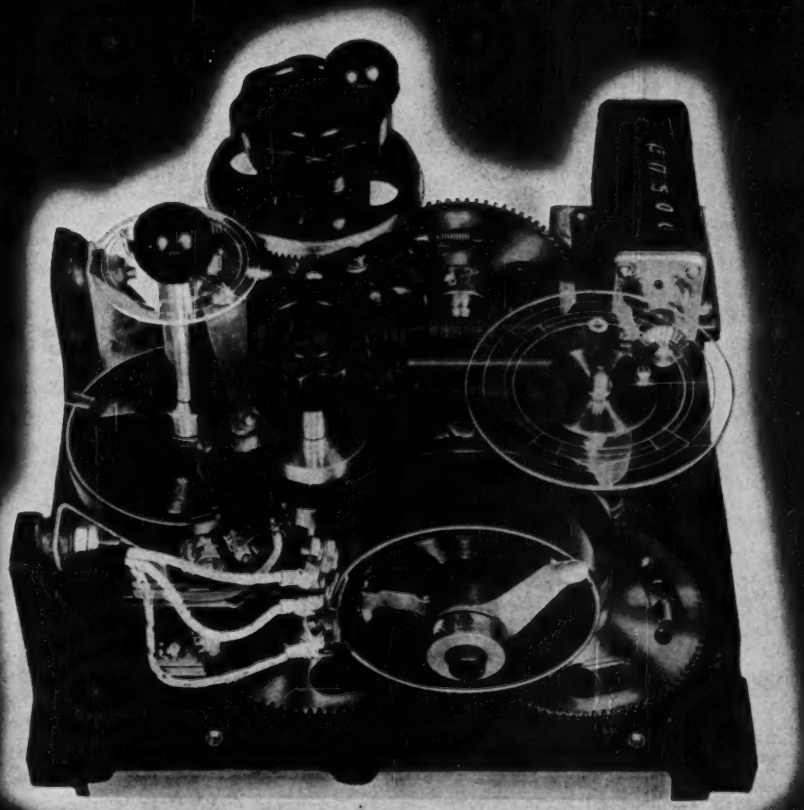
CAMBRIDGE THERMIONIC CORP., 437 Concord Ave., Cambridge 38, Mass. Type LS-8 slug-tuned coil form features silver-plated phosphor bronze clip terminals which cannot loosen. Height is 23/32 in.; maximum diameter, ¼ in. Coil form is of grade L-5 silicone—impregnated ceramic. The slug is provided with a spring lock. All metallic parts except clips are cadmium plated. The unit is supplied complete with slug and all mounting hardware.



Milliampere Stabilizer

NORTH AMERICAN PHILIPS CO., 750 S. Fulton Ave., Mt. Vernon, N. Y. A new Norelco MA stabilizer is designed specifically to hold tube

Precision Electro-Mechanical Equipment ...for All Industries



ATLAS OFFERS COMPLETE ENGINEERING, PRODUCTION AND ASSEMBLING FACILITIES

Take an intricate electro-mechanical product in the pilot stage . . "iron out the kinks" . . mass produce it . . . and assemble it with finest precision. That's the service Atlas "Precisioneers" offer American Industry. Extra hands to speed the output of vitally needed products that must be sub-contracted.

Atlas has an engineering and development staff capable of designing for mass production. Skilled craftsmen of the high speed machine tools, precision grinders, gear cutters and stamping presses. Experienced and exacting operators are on every assembly line to assure precision finished assemblies.

Atlas "Precisioneers" are master craftsmen of every step of the way in producing fine precision electro-mechanical assemblies — all services under one roof, under one responsibility. Whether you need a sub-contractor to mass produce assemblies for you or a source of supply for precision parts, Atlas offers you complete facilities. Speed your production — write for "Precisioneers For Industry."

ATLAS METAL STAMPING COMPANY
KENSINGTON AND CASTOR AVENUES
PHILADELPHIA 24, PENNA.

ALTEC for every broadcast need!

When you buy for broadcast you want the best ... and Altec makes the best microphones for every phase of broadcasting and telecasting. Altec microphones are outstanding for everyday use and will exceed even the most exacting requirements when called upon for special jobs. If you are not already familiar with these exceptional microphones, expose yourself to their undeniable advantages.

For quality, the omnidirectional 21B has no peer. In video, if the mike must be shown, the 21B will be virtually invisible. Quality, ruggedness, small size and eye-appeal make the 21B outstanding above all others.

The 639B is the well known standard for directional microphones. When studio noise or other conditions dictate a directional unit, the 639B with its six selective patterns is sure to fill the need.

The 633 "saltshaker" has long been popular for general studio and field use. For ruggedness and quality at moderate price there is no better.

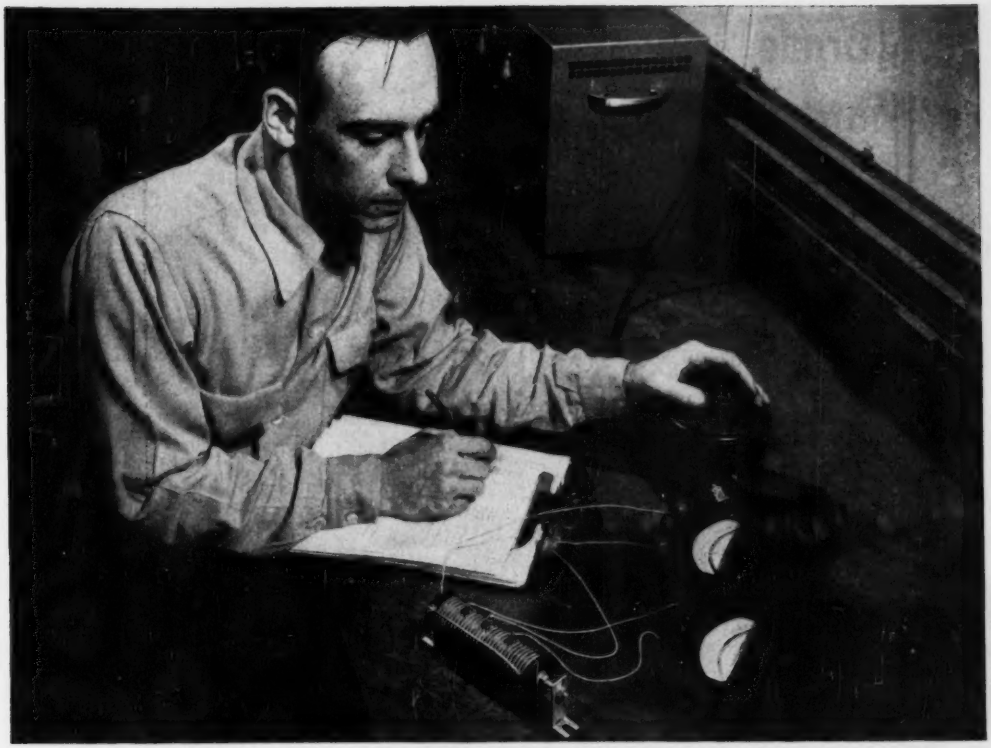
ALTEC LANSING CORPORATION

9356 Santa Monica Boulevard, Beverly Hills, California

current constant at any given setting when used in conjunction with the company's water-cooled x-ray diffraction equipment. For work where extremely constant x-ray tube current is important, the unit will be of great benefit since it has three ranges; 0.5 to 2 ma, 7 to 25 ma and 25 to 50 ma. The three stages are easily selected by means of a three-position lever switch mounted on the end of the stabilizer chassis. Safety circuits are employed which protect the x-ray tube filament from excessive heating and at the same time permit the regulator to be turned on by the main power switch. The stabilizer holds to within 0.1 percent any irregularities in the x-ray tube filament current due to such things as change in contact resistance or change in filament characteristics due to heat.

Kilovoltmeters

BETA ELECTRIC CORP., 333 E. 103rd St., New York 29, N. Y., announces the series 111 kilovoltmeters, medium precision units for measuring high voltage d-c up to 200,000 v. They consist of a separate multiplier case and meter cabinet. The meter multiplier is immersed in a large mass of nonhygroscopic wax, enclosed in a Bakelite cylinder. The wax renders the multiplier insensitive to changes of ambient atmospheric conditions. Guaranteed accuracy is 4 percent of full scale over the entire range of the instruments. This includes the 1-percent yearly variations due to ambient conditions. Sensitivity of the 50-kv unit is 20,000 ohms per volt; for the



TEST FOR FORWARD VOLTAGE DROP (ABOVE) REQUIRES ONLY VARIABLE A-C SUPPLY, A-C VOLTMETER AND D-C AMMETER

Easy comparison tests show G-E rectifier quality

TESTS FOR LIFE of high-voltage, G-E selenium rectifiers made on convection-cooled and forced ventilation racks (above) indicate that forward resistance increases less than 6% after 10,000 hours operation.

Make these tests yourself—and you'll keep your product out in front with G-E selenium rectifiers

Most engineers know that metallic rectifiers don't follow Ohm's law. But tests for rectifier quality and operating characteristics are easy to make. General Electric invites you to make these tests, and compare G-E selenium rectifiers with any others on the market today. You'll find G-E rectifiers outstanding in these four important qualifications.

LOWER FORWARD RESISTANCE. This means higher output and cooler operation—plus lower costs in circuit components and design.

LESS BACK LEAKAGE. For higher efficiency, as well as higher output and cooler operation.

COOLER OPERATION. Due to both of the above characteristics; because there's less heat to dissipate, less ventilation is required.

LONGER LIFE. Expected life at rated output: over 60,000 hours!

For details on comparison tests of selenium rectifiers, write for Bulletin GEA-5524 to Section 461-19, General Electric Co., Schenectady 5, N. Y., or arrange for test details and sample units through an authorized G-E agent or your nearest G-E office.

GENERAL ELECTRIC

461-19

Test, Grade, or Match Resistors

"as fast as you can pick 'em up!"

PRICE $585.00 FOR CINCINNATI

with the new *Clippard* PR-5 RESISTANCE COMPARATOR

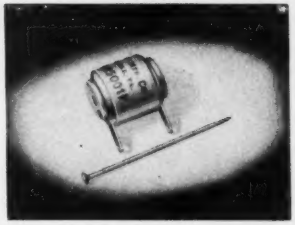
Just place the "unknown" resistance across the terminals of this precision, production Clippard tester. Even unskilled operators can process up to 17 resistors (of all types) *per minute.* Working to an accuracy of better than ±1% through the entire range of 100 ohms to 100 megohms, the PR-5 is a companion instrument to the famous PC-4 Automatic Capacitance Comparator. With it, radio, electrical, resistor manufacturers and large part jobbers save time and money and assure unerring accuracy of inspection.

Completely self-contained, the PR-5 requires no outside attachments other than the Standard Resistor against which unknowns are checked. Operates on 110 Volt—60 Cycle AC. Range: 100 ohms to 100 megohms; reads deviation from standard on any of three scales: −5% to +5%, −25% to +30% or −50% to +100%. Size: 18" x 12" x 12". Weight: approx. 32 lbs. For complete details, write for Catalog Sheet 1-E.

Clippard
INSTRUMENT LABORATORY INC.
1125 Bank Street • Cincinnati 14, Ohio

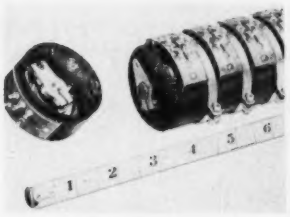
MANUFACTURERS OF R. F. COILS AND ELECTRONIC EQUIPMENT

150 and 200-kv units, 10,000 ohms per volt.



Precision Resistors

SHALLCROSS MFG. CO., Collingdale, Pa., has announced a line of miniature hermetically-sealed resistors with solder lug terminals and designed to meet the requirements of JAN-R-93, characteristic A, style RB11. Known as Akra-ohm type 1180, the resistors are only 19/32 in. long × ¼ in. diameter and are rated 0.25 watt at 250 v. Resistance values up to 0.1, 0.3 or 0.4 megohm may be obtained depending on the alloy wire used for the noninductive winding. This and other types are fully described in bulletin R-3b.



External Phasing Potentiometer

DE JUR-AMSCO CORP., 45-01 Northern Blvd., Long Island City, N. Y., has added the C-200 series to its line of precision potentiometers, designed and engineered for precision instrument, computer and military applications. These units are available singly or ganged up to any number, and still maintain the same degree of mechanical and electrical accuracy in any combination of both linear and nonlinear resistance windings. Mechanical rotation is 360 deg continuous and electrical rotation 320 deg ± 1 deg. Resistance range is 10 to 200,000 ohms

NEWS FLASH FROM LONDON

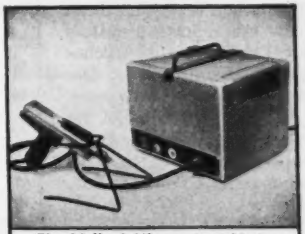
ALUMINUM SOLDERING REVOLUTIONISED

by world's first commercial *ULTRASONIC* soldering equipment

IS the soldering of aluminum one of your production difficulties? Then here's the biggest — and best — news for you in years. The industrial problem of soldering aluminum and other metals that form refractory oxides has at last been overcome in a practical, commercial form by the use of ultrasonics.

The new soldering equipment developed in the Mullard Research Laboratories destroys oxide film by ultrasonic cavitation and provides a "clean" metallic surface.

The equipment comprises a small electronic amplifier for supplying the ultrasonic power, and a soldering gun.



The Mullard Ultrasonic Soldering Gun and Amplifier. The unit operates from A.C. mains and is robustly made to suit workshop conditions.

Two controls, a mains switch on the amplifier and a trigger on the gun, make the operation simple.

No flux is needed and standard soft solders can be used. Unskilled workers can operate the equipment with absolute ease and safety. And, since the ultrasonic frequency employed is inaudible to the human ear, there is no discomfort to the operator.

Here is the practical solution to the tinning of aluminum and its alloys.

You can learn more about the Mullard Ultrasonic Soldering Equipment by mailing the coupon.

Deliveries can now be made immediately from stock.

Mullard

ELECTRONIC TUBES · RADIO · TELEVISION · X-RAY TUBES · LAMPS
SCIENTIFIC INSTRUMENTS · COMMUNICATIONS EQUIPMENT
MAGNETIC MATERIALS · ULTRASONIC GENERATORS

Mullard Overseas Ltd., Electronic Equipment Division, Century House, Shaftesbury Avenue, London, W.C.2, England.

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In USA—International Electronics Corp., 137 Hudson St., New York 13, N. Y.
Exclusive Distributors of Mullard Products in the United States
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(MREIOS)

The control console

A bank of 84 Struthers-Dunn Type 112XAX relays that control indicating lights corresponding to the alarm code.

432 S-D relays help Philadelphia report "*Fire!*" in 8 seconds

In 8 seconds after the alarm box lever has been pulled, the Quaker City's new fire reporting system receives alarms from 3200 local boxes and dispatches them to the proper fire house and its alternates. Designed by Philadelphia Electrical Bureau engineers, this intricate installation—the most modern of its kind in the world—uses 432 standard Struthers-Dunn relays. Since July 1949, these relays have been in constant service and not one has required adjustment, cleaning or service of any kind.

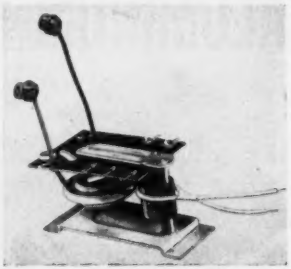
STRUTHERS-DUNN

5,348 RELAY TYPES

STRUTHERS-DUNN, INC., 150 N. 13th ST., PHILADELPHIA 7, PA.

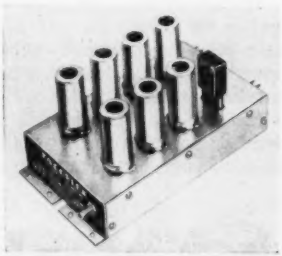
BALTIMORE • BOSTON • BUFFALO • CHARLOTTE • CHICAGO • CINCINNATI
CLEVELAND • DALLAS • DETROIT • KANSAS CITY • LOS ANGELES
MINNEAPOLIS • MONTREAL • NEW ORLEANS • NEW YORK • PITTSBURGH
ST. LOUIS • SAN FRANCISCO • SEATTLE • SYRACUSE • TORONTO

up to ± 1 percent. Linearity accuracy is up to ± 0.25 percent. The potentiometer is rated at 4 watts. Operational life is 1,000,000 cycles dependent on rating.



TV Autotransformer

RAM ELECTRONICS SALES CO., 7 South Buckhout St., Irvington-on-Hudson, N. Y. Type XO54 replacement and conversion tv autotransformer requires less driving power than a true transformer and yet provides ample high voltage and sweep for tube sizes up to 21 in. rectangular. In sets using selenium-rectifier voltage doubler circuits with 250 volts B+ supply, the XO54 produces 13.5 kv with a boost voltage of 430 v; with standard power supplies, it produces 15 kv with a boost voltage of 500 v. The unit has excellent regulation and linearity and needs no special coils. Its new high-permeability ferrite core combined with special windings results in good efficiency.



Channel Converter

TECHNICAL APPLIANCE CORP., Sherburne, N. Y., has designed a channel converter for use with the Tacoplex antenna distribution system. It beats the higher channel

VOLTAGE REGULATED POWER SUPPLIES

For Industrial and Research Use

MODEL 815

B SUPPLY: 0-600 volts, 200 Ma.
C SUPPLY: 0-150 volts, 5 Ma.
FILAMENT SUPPLY: 6.3 volts AC, 10 Amp., CT.

DC POWER SUPPLY SPECIFICATIONS

REGULATION: ½% for both line (105-125 volts) and load variations.
REGULATION BIAS SUPPLIES: 10 millivolts for line 105-125 volts.
½% for load at 150 volts.
RIPPLE: 5 millivolts RMS.

VOLTS	CURRENT	MODEL
100-325 0-150 Bias 6.3 AC.CT.*	0-150 Ma. 0-5 Ma. 10 Amp.	131
200-500 6.3 AC.CT.	0-200 Ma. 6 Amp.	245
0-300 0-150 Bias 6.3 AC.CT.	0-150 Ma. 0-5 Ma. 5 Amp.	315
0-500 6.3 AC.CT.	0-300 Ma. 10 Amp.	500R
#1 200-500 #2 200-500 #3 6.3 AC.CT. #4 6.3 AC.CT.	0-200 Ma. 0-200 Ma. 6 Amp. 6 Amp.	510
0-500 0-150 Bias 6.3 AC.CT.	0-200 Ma. 0-5 Ma. 10 Amp.	515
#1 0-500 #2 0-500 #3 6.3 AC.CT. #4 6.3 AC.CT.	0-200 Ma. 0-200 Ma. 10 Amp. 10 Amp.	600

VOLTS	CURRENT	MODEL
0-500 0-150 Bias 6.3 AC.CT.	0-300 Ma. 0-5 Ma. 10 Amp.	615
#1 0-600 #2 0-600 #3 6.3 AC.CT. #4 6.3 AC.CT.	0-200 Ma. 0-200 Ma. 10 Amp. 10 Amp.	800
0-600 0-150 Bias 6.3 AC.CT.	0-200 Ma. 0-5 Ma. 10 Amp.	815
0-1000-Ripple 10 mv. 6.3 AC.CT.	0-50 Ma. 10 Amp.	1020
0-1200-Ripple 10 mv. 6.3 AC.CT.	0-20 Ma. 10 Amp.	1220
200-1000-Ripple 20 mv.	0-500 Ma.	1250
0-1000-Ripple 20 mv.	0-500 Ma.	1350
Specify your voltage and current requirements. Regulation available .5%, .1%, .01%.		SPECIAL SERIES

*All AC Voltages are unregulated. All units are metered except Models 131 and 315.

All units designed for relay rack mounting or bench use.

The Kepco Voltage Regulated Power Supplies are conservatively rated. The regulation specified for each unit is available under all line and load conditions, within the range of the instrument. Write for specifications.

MANUFACTURERS OF ELECTRONIC EQUIPMENT • RESEARCH • DEVELOPMENT

KEPCO LABORATORIES, INC.

149-14 41st AVENUE • FLUSHING, N. Y.

We're sorry, but we think it's only fair to tell possible new customers our Standing Room Only sign must be changed to Sold Right Out!

The design and production facilities of our microwave department are now taken over by the increasing requirements of our present customers. Because of our responsibility to them, this situation may continue quite a while.

We are sorry to say this because we enjoy making new friends. But we feel that we should tell those who might be interested in our engineering and manufacturing facilities, that for some time we may not be able to serve them.

Any change in the situation will be announced in this publication.

L. H. TERPENING COMPANY
DESIGN • RESEARCH • PRODUCTION
Microwave Transmission Lines and Associated Components
16 West 61st St. • New York 23, N. Y. • Circle 6-4760

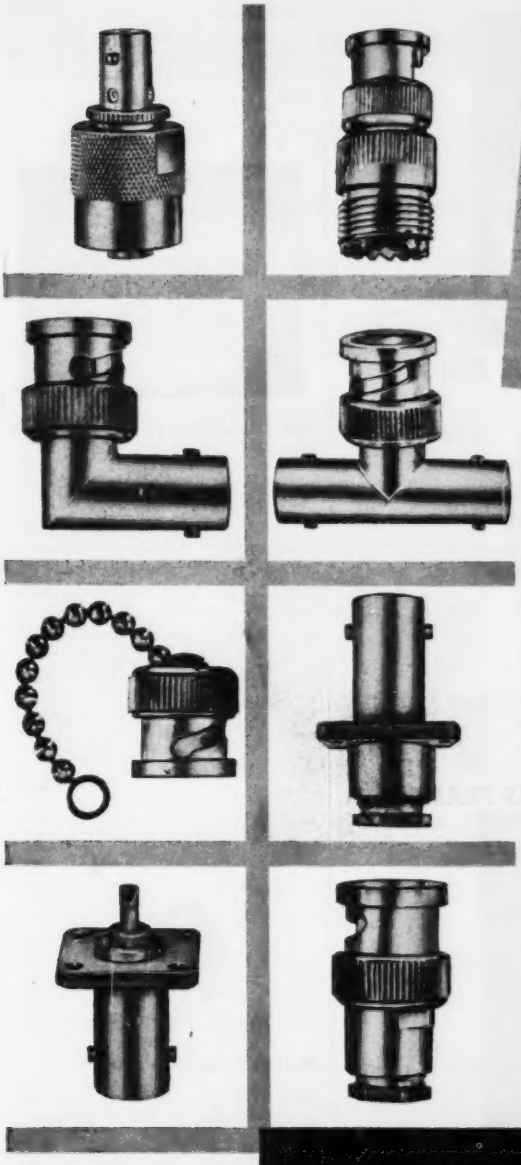
signals down to a low-band open channel. For example, if channel 13 is operating in a region where the only other channel is 4, the channel converter located at the antenna station converts the signal to channel 2 and transmits that signal through the cables. The receiver operator tunes his receiver to channel 2 to pick up the channel 13 signal. The converting is done by means of a crystal oscillator so that there is no drift in the frequency.

Open-Wire Transmission Line

JFD MFG. CO., 6101 Sixteenth Ave., Brooklyn 4, N. Y., has developed the Super-Gain open-wire transmission line made of copper wire with a steel core and insulated by sturdy low-loss polystyrene spacers. It delivers ¼ the decibel loss of regular 300-ohm twinex lead-ins. Excellent for long-line set-ups, it has a 400-lb. breaking point tensile strength. It is being packed on spools in three lengths: 100, 250 and 500 ft.

SWR & R-F Power Meters

M. C. JONES ELECTRONICS CO., 96 North Main St., Bristol, Conn., announces a new line of small, portable r-f power and swr meters. Model MM700 series Micro Match operates at power levels of 0.1 to 1,200 watts over the frequency range of 30 to 200 mc. The instrument weighs less than 2 pounds and requires no external source of power. It is desiged for use in making laboratory measurements



BNC CONNECTORS BY KINGS

The B N C Connectors shown are small, lightweight Connectors designed for use with small cables such as RG-58/u, RG-59/u and RG-71/u. Widely used for video and aircraft test equipment, they are recommended for frequencies as high as 3000 M.C., where impedance matching is important. The B N C series is used successfully in the region of microwave frequencies.

Whether your connector requirements call for the B N C series, N series, the new C series or special adaptations of standard connectors, you can rely on Kings. Our staff of highly specialized engineers invite your inquiries.

KINGS *Electronics* **CO., INC.**

40 MARBLEDALE ROAD, TUCKAHOE, N. Y.

IN CANADA: ATLAS RADIO CORP., LTD., TORONTO

MORE POWER

GH-368 HYSTERESIS SYNCHRONOUS MOTOR

MOST POWERFUL MOTOR MADE IN THIS FRAME

FULL 1/16 HP AT 1800 RPM
SIZE 4-3/8" x 5-7/8"

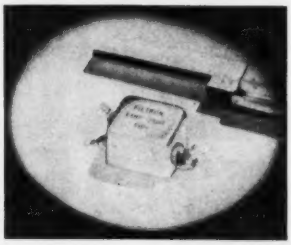
- 115V 60 CY SINGLE-PHASE
- CAP. START AND RUN, 5 MFD.
- TEMP. RISE 40° CONTINUOUS DUTY
- RATED LOAD 1.2 AMP.
- REVERSIBLE
- PULL-OUT TORQUE 2.5 IN. LB.
  PULL-IN TORQUE 2.55 IN. LB.
  STARTING TORQUE 2.65 IN. LB.

OTHER UNITS AVAILABLE IN VARIETY OF SIZE, VOLTAGES, AND FREQUENCIES . . . ONE, TWO, AND THREE PHASE.

ELECTRIC INDICATOR CO.
CAMP AVE., SPRINGDALE, CONN.

DESIGNERS AND MANUFACTURERS OF GOVERNOR-CONTROLLED, SELF-SYNCHRONOUS, DRAG-CUP, DC AND AC TACHOMETER, SHUNT, SERIES, COMPOUND, PERMANENT-MAGNET, SPLIT-FIELD, SEPARATELY EXCITED, UNIVERSAL, INDUCTION, RELUCTANCE, HYSTERESIS, DC & AC SERVO, REELMOTOR, TOTALLY-ENCLOSED, AC DYNAMICALLY BRAKED, STABILIZED HYSTERESIS, MULTIPLE-SPEED, PRECISION FRACTIONAL HORSE-POWER MOTORS AND GENERATORS.

and for monitoring both transmitter and antenna performance in the field.



R-F Interference Suppression Filter

THE FILTRON CO., INC., 131-05 Fowler St., Flushing, N. Y., has introduced a smaller and lighter 3-ampere 125-volt a-c, 400-cycle subminiature r-f interference suppression filter. It features high attenuation and is hermetically sealed with glass solder sealed terminals. The unit is designed for 100 C operation.

Portable Radiophone

MOTOROLA INC., 4545 W. Augusta Blvd., Chicago 51, Ill. A new version of the Handie-Talkie portable f-m radiophone incorporates an adjustable squelch that reduces the annoyance of tube and circuit noises normally encountered in an f-m receiver in the absence of a signal. The squelch control, mounted on the power-supply chassis, provides a normal operating range of no-squelch up to 25 to 50-db noise reduction. The portables are available with either wet or dry cell power supplies for operation in

The SELENIUM RECTIFIER DIVISION of *Federal Telephone and Radio Corporation*

Offers its Outstanding Engineering and Manufacturing Facilities to

GOVERNMENT CONTRACTORS

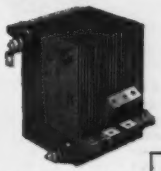
Consult us for your Aircraft, Ground and Naval Requirements

Federal has years of experience in meeting military specifications

THE Selenium Rectifier Division of Federal—the nation's headquarters for selenium rectifiers—is ready to serve you with start-to-finish production of power supplies, battery chargers, voltage regulators, engine starters, cathodic protection and other units—compact, rugged, quiet, dependable power equipments designed for *any* DC output.

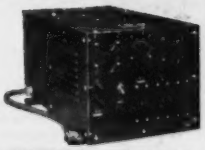
Federal *knows* selenium rectifiers. Federal has unmatched power conversion experience . . . an experience backed by *years* of successfully meeting the rigid requirements of contracts for military equipments. And Federal has the capacity to deliver your orders—*when you want them!*

Mail us your specifications today! Write to Dept. E-813.

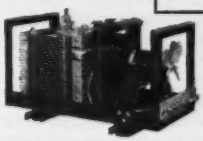


Heavy-duty Federal Selenium Rectifier

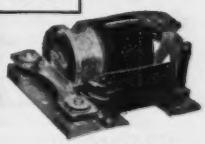
DESIGNED AND BUILT BY FEDERAL



FTR 3414-AS Ground Aircraft Power Supply



FTR 3146-BS Aircraft Power Supply



FTR 3141-CS-03 Clip-in Voltage Regulator

"America's Oldest and Largest Manufacturer of Selenium Rectifiers"

FEDERAL TELECOMMUNICATION LABORATORIES, Nutley, N. J. . . . . a unit of IT&T's world-wide research and engineering organization.

Federal Telephone and Radio Corporation

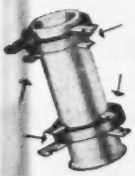
100 KINGSLAND ROAD · · · CLIFTON, NEW JERSEY

In Canada: Federal Electric Manufacturing Company, Ltd., Montreal, P. Q.
Export Distributors: International Standard Electric Corp., 67 Broad St., N.Y.

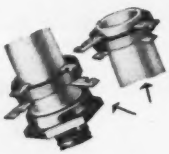
A Big Step Forward In Ceramic Coil Forms!

C.T.C.'s Nylon-Phenolic Terminal Retainers Mean More Advantages . . . *More Uses* . . . Than Ever Before

In making available ceramic coil forms with nylon-phenolic terminal retaining rings, C.T.C. now enables you to extend your use of these components considerably. The use of nylon-phenolic in no way impairs the moisture and fungus resistant qualities of the coil form assemblies. The nylon rings also provide many new benefits. For example:



Excellent For Bifilar Windings. Four separate terminals, two on each nylon-phenolic ring, mean secure individual connections for each coil lead.



New Advantage For Single Pie Windings. Terminals can be located above or below winding, as required, to shorten wiring to circuit elements.

Soldering Spaces Doubled. Shape of terminals affords two soldering spaces on each, to segregate coil terminations from circuit wiring.

Terminals Held Securely In Place. Firmly cemented nylon-phenolic rings keep terminals in exact position. No sliding up or down.

In addition, the use of nylon-phenolic rings results in an increase in Q, giving improved performance over metallic rings. All materials and finishes meet exacting government specifications. Available with LST, LS5, LS6 coil forms.

SPECIAL CONSULTING SERVICE

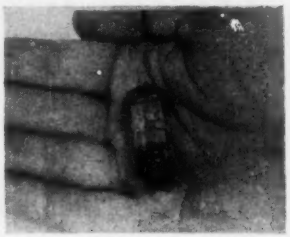
C.T.C.'s experienced component engineers are at your service — without cost — to help you secure exactly the *right* components. When standard parts are unsuitable they will design special units, working closely with you for economical, satisfactory results.

Call on the C.T.C. Consulting Service at any time. Just write to Cambridge Thermionic Corporation, 437 Concord Avenue, Cambridge 38, Massachusetts. West Coast stocks maintained by E. V. Roberts, 5014 Venice Blvd., Los Angeles and 988 Market Street, San Francisco, Cal.

custom or standard... the guaranteed components

CTC

either the 25 to 50-mc or the 152 to 174-mc bands.

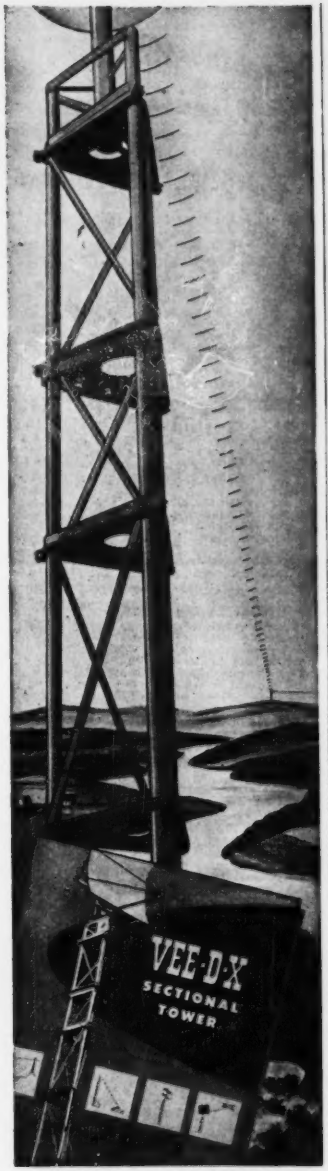


Miniature Thyratron

GENERAL ELECTRIC CO., Syracuse, N. Y. Type GL-5727 miniature thyratron tube is built for long-life use in mobile and aircraft control circuits. A four-electrode inert-gas-filled unit with negative control characteristics, it is suitable for use in relay and grid-controlled rectifier applications. The tube will operate at temperatures ranging from −75 C to +90 C. It has a high degree of mechanical strength, low grid-anode capacitance and very low grid currant. It is rated for 100-ma average plate current.

VTVM

ELECTRONIC MEASUREMENTS CORP., 280 Lafayette St., New York 12, N. Y. Model 106 vacuum-tube voltmeter is specially designed for field alignment of radio and tv sets, is completely electronic on all functions and ranges and has five a-c/d-c and ohms ranges. Featuring a 1½-v range for both a-c and d-c volts, the instrument is housed in a molded Bakelite case that measures

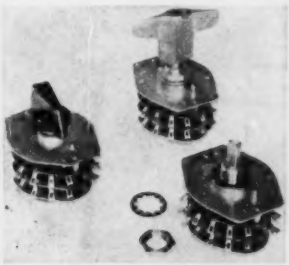


MOST ECONOMICAL TOWER

for **MICROWAVE COMMUNICATIONS TV and FM RADAR**

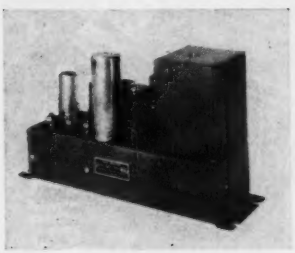
THE LaPOINTE-PLASCOMOLD CORPORATION
Windsor Locks, Connecticut

7¼ × 5¼ × 2¾ in. with a net weight of 3 lb. Price is $35.90.



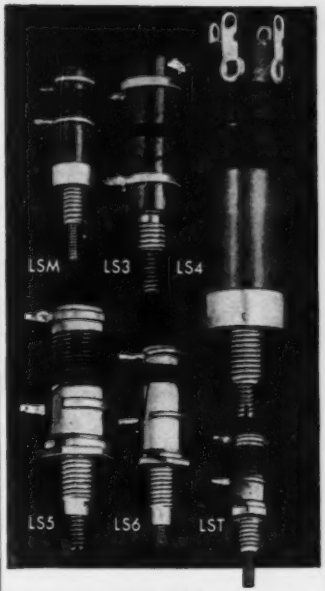
Rotary Selector Switch

UNITED STATES INSTRUMENT CORP., 409 Broad St., Summit, N. J., recently announced a revised line of type JA rotary selector switches designed for applications requiring a large number of contact points with multiple decks and manufactured to meet government specifications. Each deck is self-contained, self-aligning, easily removed and replaced as required. The "O" ring seal on both shaft and mounting bushing allows watertight mounting of each switch. A catalog sheet giving general specifications is available.



Servo Amplifier

INDUSTRIAL CONTROL CO., 26–02 Fourth St., Long Island City 2, N. Y. Model 410-B is a 60-cycle servo amplifier designed to drive a motor with 5-watt output. In it the three factors of the servo loop (gain, damping and carrier phase) are controlled by slotted shaft potentiometers. This insures that a stock unit can be used in a large number of different applications without requiring additional plug-in packages or assemblies. Specifi-



WHICH COIL FITS YOUR NEEDS?

COIL FORMS WOUND TO YOUR SPECIFICATIONS

C.T.C. will furnish slug tuned coils with either single layer or pie type windings to fit your needs. Small or large production quantities. Coil forms also available.

For military contracts: the materials, methods and processes used in C.T.C. products meet all applicable government specifications.

SEND COMPLETE SPECIFICATIONS FOR SPECIALLY WOUND COILS

COIL FORM SPECIFICATIONS

Coil Form	Material	Mounting Stud Thread Size	Form O.D.	Mounted O.A. Height
LST*	L-5 Ceramic	8-32	⅜″	19/64″
LS6	L-5 Ceramic	10-32*	½″	27/64″
LS5	L-5 Ceramic	¼-28*	⅝″	1 ⅛″
LS8 (not shown)	L-5 Ceramic	¼-28	½″	29/64″
LSM	Paper Phenolic	8-32	¼″	27/64″
LS3	Paper Phenolic	¼-28	⅝″	1 ⅛″
LS4†	Paper Phenolic	¼-28	½″	2″

*These types provided with spring locks for slugs.
†Fixed lugs. All others have adjustable ring terminals. LST, LS5, LS6 also available with fixed terminals secured by Nylon collars.
*LST: same as LST but with slug locking spring.
All ceramic forms are silicone impregnated. Mounting Studs of all forms are cadmium plated.

custom or standard the guaranteed components

CAMBRIDGE THERMIONIC CORPORATION
437 Concord Ave., Cambridge 38, Mass.
West Coast Stock Maintained By: E. V. Roberts, 5014 Venice Blvd., Los Angeles, and 938 Market Street, San Francisco, California.

★ To better serve Arizona, we are pleased to announce the opening of our **Phoenix office, 32 West Jefferson Street,** under the direction of **William R. Saxson,** Field Engineer.

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LESA manufacture potentiometers for all requirements. With 20 years research and experience behind us, our products are known and recognised for their quality throughout the world. Write for complete information and catalog.

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Electrometer Circuit Components

QUALITY and ASSURANCE

5800
ELECTROMETER TETRODE

The 5800 is a low filament power, subminiature tetrode designed specifically for electrometer applications. The envelope has been specially treated for low leakage and the emission has been stabilized for DC amplifier applications.

CHARACTERISTICS	
Filament Voltage	1.25 v
Filament Current	10 ma
MAXIMUM RATINGS	
Filament Voltage	1.5 v
Plate Voltage	50 v
Average Cathode Current	500 μa
TYPICAL OPERATION	
Plate Voltage	+4.5 v
Accelerator Grid Voltage (g_1)	+3.4 v
Control Grid Voltage (g_2)	−3 v
Amplification Factor	1
Transconductance	15 μmhos
Plate Current	12 μa
Accelerator Grid Current	300 μa
Control Grid Current	10^{-15} amp

5803
ELECTROMETER TRIODE

A subminiature triode to supplement the 5800 tetrode. The same high quality construction and testing goes into both these tubes. This tube is useful in one-stage circuits to drive a microammeter or a micro-relay.

CHARACTERISTICS	
Filament Voltage (AC-DC)	1.25 v
Filament Current	10 ma
MAXIMUM RATINGS	
Filament Voltage	1.5 v
Plate Voltage	50 v
Average Cathode Current	500 μa
TYPICAL OPERATION	
Plate Voltage	7.5 v
Grid Voltage	−1.7 v
Transconductance	150 μmhos
Plate Current (Zero Signal Condition)	100 μa
Grid Current	2×10^{-14} amp

HI-MEG RESISTORS

Victoreen's Hi-Meg Resistors have been developed for use where stability, accuracy, and high humidity operation are of prime consideration. The resistor element is vacuum sealed in a glass envelope. The glass has been treated with a silicone varnish and the resistor has been aged to prevent drift.

CHARACTERISTICS	Min.	Max.
Resistance Range*	10^8	10^{12} ohms
Tolerance from your Specified Resistance*	−10	+10%
Tolerance from Labeled Resistance	−1	+1%
Temperature Coefficient	−.06	−.13%/°C
Voltage Coefficient	−0	−.03%/v

OPERATING CONDITIONS	Min.	Max.
Temperature	−40	120°C
Voltage	.0001	1000v
Relative Humidity	0	98%

*Higher resistance or closer tolerances are available on special request.

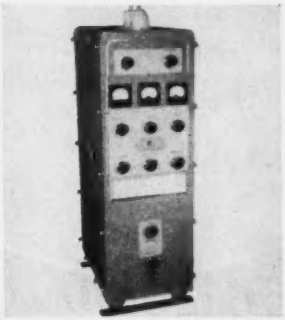
BETTER COMPONENTS MAKE BETTER INSTRUMENTS

Victoreen Instrument

Components Division

3800 Perkins Ave. **Cleveland 14, Ohio**

cations are as follows: maximum gain, 1,000; phase variable from +20 to −140 deg; internal pickup below 3 mv rms; moderate power supply requirements.



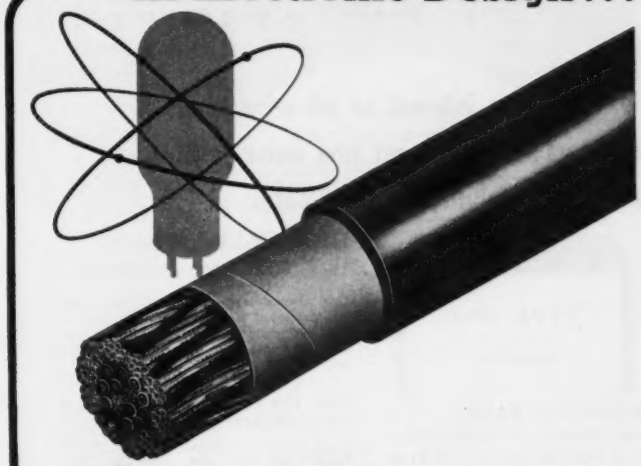
Marine Radio Transmitter

RADIOMARINE CORP. OF AMERICA, 74 Varick St., New York 13, N. Y. Model ET-8019E 200-watt high-frequency radiotelegraph transmitter employs crystal frequency control, using the new type R-6 crystals, permitting greater stability and minimum tolerances. It is designed to cover a continuous frequency range or from 2 to 22.4 mc. Provision is made for a maximum of 10 crystals, although 25 output frequencies may be obtained from only 6 crystals.

Signal Generator

RADIO CITY PRODUCTS CO., INC., 152 W. 25th St., New York, N. Y., has announced the new wide-range model 706A signal generator. The instrument provides high stability and accuracy in continuous coverage of 150 kc to 220 mc. This is accomplished in 8 ranges, 6 being

In Electronic Design...



Rome Cable can solve your special wiring problem...

The wiring in any electronic device is of vital importance. When complexity of design calls for *exacting* cable requirements, let Rome Cable give you a hand.

Rome's engineering staff, skilled in electronics and backed by competent research, can develop for you the type of cable construction most *exactly* suited to your particular requirement. Rome's manufacturing facilities are sufficiently diversified to produce *exactly* the type of cable you need. Rome's step-by-step control of quality assures you of uniformity and dependability of performance. Take advantage of Rome Cable's experience, as so many others have done.

In addition, Rome Cable manufactures a complete line of standard Underwriters' approved, as well as military type radio and television hook-up wires utilizing both rubber and thermoplastics. So, whatever your wire or cable requirements, look to Rome for dependable quality. For descriptive literature, mail the coupon below today!

Copper wire mill products are a Controlled Material under N.P.A. Controlled Materials Plan . . . USE YOUR CMP ALLOTMENT.

IT COSTS LESS TO BUY THE BEST

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Please send me information on Electronic Wiring.

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Company.....
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ROME CABLE CORPORATION
ROME, NEW YORK and TORRANCE, CALIFORNIA

S·S·White MOLDED RESISTORS

The All-Weather Resistors

Of particular interest to all who need resistors with inherent low noise level and good stability in all climates

HIGH VALUE RANGE
10 to 10,000,000 MEGOHMS

This unusual range of high value resistors was developed to meet the needs of scientific and industrial control, measuring and laboratory equipment — and of high voltage applications.

STANDARD RANGE
1000 OHMS TO 9 MEGOHMS

Used extensively in commercial equipment including radio, telephone, telegraph, sound pictures, television, etc. Also in a variety of U. S. Navy equipment.

SEND FOR BULLETIN 4906

It gives details of both the Standard and High Value resistors, including construction, characteristics, dimensions, etc. Copy with Price List mailed on request.

THE S.S.White INDUSTRIAL DIVISION
DENTAL MFG. CO.
Dept. R, 10 East 40th St.
NEW YORK 16, N. Y.
Western District Office • Times Building, Long Beach, California

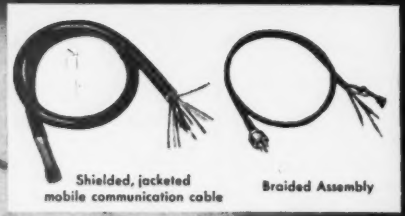
PHALO

"Current's Favorite Conductor"

Provides Versatile Quality for Mobile Communication!

Year after year, hundreds of thousands of feet of shielded connecting cables bearing the famous "Current's Favorite Conductor" trademark, find their way into the nation's best mobile radio and telephone communication systems.

Phalo builds shielded cables that are as versatile as the systems they connect . . . whatever the purpose, you couldn't find a better quality answer. Next time specifications call for shielded communication cable, call for PHALO and be certain!



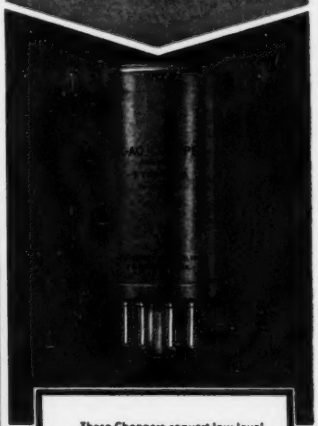
PHALO Plastics Division

Manufacturers of Thermoplastic Insulated Wire, Cord Sets and Tubing to Government Specifications

CORNER OF COMMERCIAL STREET, WORCESTER, MASSACHUSETTS

DC - AC CHOPPER

A model for every use.
10 — 500 cycles AC
Meets AN Specifications
also 60 cycles
Single pole and double pole
Make before-break contacts
Contacts in air or in liquid



These Choppers convert low level DC into pulsating DC or AC so that servo-mechanism error voltages and the output of thermocouples and strain gauges, may be amplified by means of an AC rather than a DC amplifier.

They are hermetically sealed, precision vibrators having special features which contribute to long life and low noise level.

WRITE FOR THESE CATALOGS . . .

#280
10-500 cycles

#246A
60 cycles

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INCORPORATED

22 ELKINS STREET
SOUTH BOSTON 27, MASS.

fundamental frequencies covering through 55 mc. Accuracy is maintained within 1 percent of calibration. Stability and constancy of calibration is assured by special electron-coupled circuit design, permeability adjusted coils and air-trimmer capacitors.

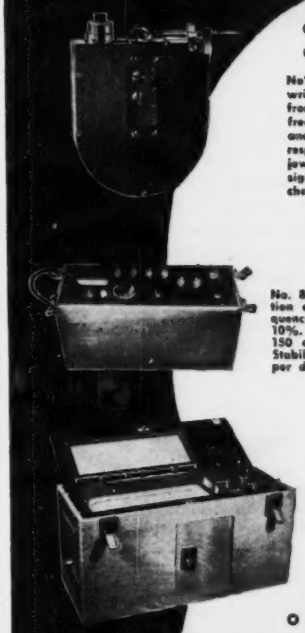
Air Flow Switch

THE HENRY G. DIETZ CO., 12-16 Astoria Blvd., Long Island City 2, N. Y., has announced the Catalog 113 vane-type pressure air flow switch for use in forced air cooling of electronic equipment. It is designed to operate a control relay to guard against tube failure in the event of blower failure or air-passage obstruction. It will operate on a minimum static pressure of 0.2 in. water gage. Electrical ratings of 5 amperes at 250 volts a-c are Underwriters' Laboratories approved. The extreme sensitivity is made possible by the use of a vane traveling in a duct which actuates a sensitive snap-action switch.

Picture Tube Checker

NATIONAL UNION RADIO CORP., Orange, N. J., has available a portable checker for tv picture tubes that uses a beam current test which is proportional to the light output capability of the tube. It provides also for continuity and short checking of the electron gun. The unit checks all magnetically-deflected tubes both electrostatically and magnetically focused, and all electrostatically-deflected tubes. A detailed description of the c-r tube checker may be found in a recently

Edin instruments



OSCILLOGRAPH GALVANOMETER

No's. 8001, 8002, 8003 and 8004 ink-writing galvanometers have sensitivities from 3.5 to 40 volts per cm., resonant frequencies from 15 to 120 cps., resistances from 1000 to 2000 ohms, frequency response up to 350 cps., and a single-jewel pivot construction. Units are designed for multiple operation up to 10 channels in a total width of 12 inches.

DIRECT-COUPLED AMPLIFIER

No. 8100 direct coupled amplifier has a voltage amplification of 13,000 with a maximum output of 70 volts. Frequency response from d.c. to 10,000 cps. is flat within 10%. Input impedance is 2 megohms; output impedance is 150 ohms. Input may range from 0.1 mv. to 100 volts. Stability is better than 0.1 mv. per thirty minutes, or 0.5 mv. per day. Attenuator is stepped for factors from 1 to 1000.

OSCILLOGRAPHS

Recorders can be supplied with 1, 3 or 9 chart speeds ranging from 0.1 mm./sec. to 250 mm./sec. See specifications of OSCILLOGRAPH GALVANOMETER for frequency range.

OSCILLOGRAPH AMPLIFIER

No. 8121 special amplifier has a time constant of 1 second, an exponential response to a square wave at high gain, input impedance of 1 megohm, and input form 0.1 mv. to 1000 volts. At low gain, No. 8121 becomes a DC amplifier with a voltage gain of 100 and an input of 10 mv./mm.

HIGH-GAIN AMPLIFIER

No. 8130 amplifier has a voltage gain of 1,000,000 and includes a built-in pre-amplifier. Frequency response is from 1 to 200 cps. Input may range from 10 microvolts to 100 millivolts. This amplifier is particularly suited for Biological studies.

Many other types of recording and amplifier circuits are available and special equipment can be assembled to meet particular specifications.

EDIN COMPANY, INC.
207 Main Street
Worcester 8, Mass.

Please send complete information on:

☐ RECORDERS ☐ No. 8100 AMPLIFIER
☐ NO. 8121 AMPLIFIER ☐ No. 8130 AMPLIFIER
☐ GALVANOMETERS ☐ _____
SPECIAL (Enclose details)

_____ (NAME)

_____ (NO.) _____ (STREET)

_____ (CITY) _____ (STATE)

_____ COMPANY _____ POSITION

AEROCOM MEANS TROUBLE-FREE SERVICE!
From Ground To Air or Point to Point

The model 12GLX-M, 1KW Beacon Transmitter illustrated, operates on a single frequency in the range 200-415 Kcs. Oscillator coil can be supplied crystal-controlled or self-excited. Tone oscillator provides 30% high level modulation for identification when keyed with Aerocom's model AK-3B automatic keyer. The unit can also be voice modulated. Power supply . . . any stable voltage in the range 200-240 volts, 50/60 cycles, single phase. Overall dimensions in CM, 56W x 62D x 177H. Net weight 286 kilos.

AER-O-COM

3090 DOUGLAS ROAD MIAMI 33, FLA.

Reg. U. S. Pat. Off.

DECALS
Decimeter Decals provide the newest, most convenient and economical method for marking electronic equipment.
They are easy to apply—no holes to drill—and they adhere to any surface, including wrinkle and crackle finishes. Decals often fit spaces too small for other types of marking. Decimeter Decals are inexpensive—a wide assortment can be stocked for low cost.
Decimeter Decals are printed in neat, opaque letters in a tough, clear protective coating of outstanding durability. They have a high degree of resistance to wear and abrasion. Over 300 different decals are available, including television titles, dial plates, radio titles, call letters and high-voltage signs for safety. Decimeter Decals are of the self-adhering "slip-off" type, and require no cement.
Speedy application plus the low cost of individual Decimeter Decals mean substantial savings in marking any type of electronic equipment. Write for folder 4C which lists complete line available and net prices. We will also enclose handy order form for your convenience in selecting your own assortment.
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1430 MARKET ST. INC. DENVER 2, COLO

REXOLITE 1422
(FORMERLY C. E. TEXTOLITE 1422)

COMBINES EVERY DESIRABLE PHYSICAL, CHEMICAL, & ELECTRICAL PROPERTY IN ONE INSULATING MATERIAL FOR U. H. F.

REXOLITE 1422

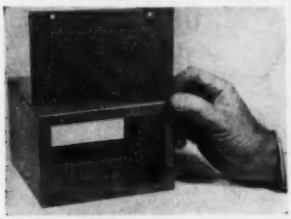
- Specifically designed to meet the growing need for a U. H. F. insulating material that's low in cost.
- Meets JAN-P-77 and MIL-P-77A specifications.
- Withstands high temperature due to its thermosetting nature.
- Has outstanding electrical properties.
- Has low specific gravity — is strong and rigid with unusually high compressive and tensile strengths.
- Has excellent impact strength and hardness allowing its use under highly abusive conditions.
- Its dimensional stability and unusual chemical inertness allow its use where other materials fail.
- Readily machinable to extremely close tolerances.
- Available as centerless ground rods in any diameter up to 1". Also cast in larger diameter rods and sheets.

Write today for technical bulletins and samples. Our engineering staff is always at your disposal.

Manufacturers of Non-strip wire, High Temperature Electrical Tubing and other extruded plastic products.

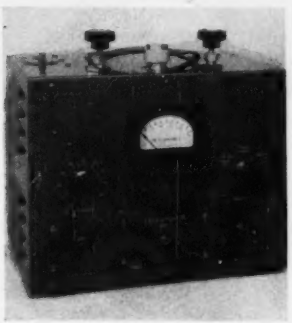
THE REX CORPORATION
65 LANDSDOWNE STREET
CAMBRIDGE 39, MASS.

published catalog sheet. Price of the unit described therein is $28.75 net.



Metal Cabinets

INSULINE CORP. OF AMERICA, 36-02 35th Ave., Long Island City 1, N. Y., has announced a new line of small utility metal cabinets featuring removable front and back covers. Especially intended for amplifiers, monitors, test sets, control units and miniature receivers and transmitters, the cabinets range in size from 4 × 2 × 4 in. to 12 × 11 × 8 in., and are available in aluminum or steel. Covers are fastened by means of self-tapping screws which are included.



Vacuum Leak Locator

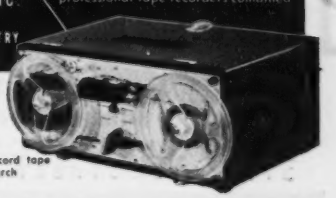
RADIO CORP. OF AMERICA, Camden, N. J., has introduced the type EMV-7 hydrogen-sensitive, ionization type leak locator, designed as a portable factory and laboratory device for detecting and locating tiny leaks during the manufacture of electron tubes or any device that can be evacuated. The instrument, weighing 31 lb, is capable of detecting leaks as small as 1×10^{-8} liter-microns of hydrogen per second. It measures 13¾ in. high, 15 in. wide

ADDS A NEW DIMENSION TO RECORDING

Now — in "sound" research, Magnecord offers you the new Binaural Tape Recorder for greater product improvement. This simultaneous-dual-channel recorder provides realistic industrial recording never before obtainable. It permits the engineer to experience binaurally the recorded sound "all around him," and makes possible the selection of one sound from many. The dual channel will also permit him to record a time signal concurrently with the test.

For greater fidelity, precision and selectivity — in laboratory, field tests, or office conferences — use the new Binaural Magnecorder!

Magnecord, INC.
HIGH FIDELITY TAPE RECORDERS FOR INDUSTRY
Used by more engineers than all other professional tape recorders combined



Write for NEW CATALOG

MAGNECORD, INC., DEPT. EA-1
360 N. Michigan Avenue, Chicago 1, Illinois
Send me further information on Magnecord tape recording for industrial "Sound" Research

Name.....
Company.....
Address.....
City..... Zone..... State.....

CONSERVE VITAL MATERIALS

Regulated HIGH VOLTAGE SUPPLY

Continuously variable
300—2500 Volts D.C.
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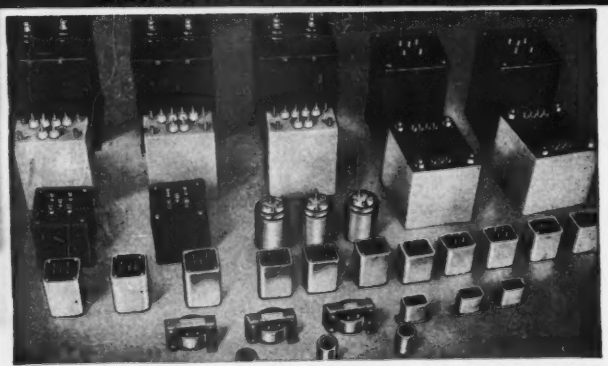

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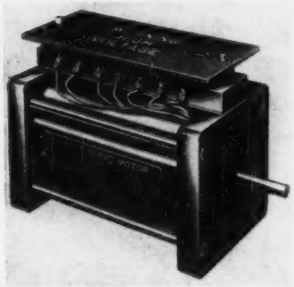
and 11 in. deep overall, and operates from a 105-125 volt, 60-cycle, a-c line.



Servo Motors

FORD INSTRUMENT CO., 31-10 Thomson Ave., Long Island City, N. Y., is now producing a complete line of low-inertia servo motors with high-voltage control windings that eliminate the need for transformers in servo amplifiers. Available in ¼, 1½, 5 and 10-watt sizes, the motors also have close-coupled windings for feedback purposes. Of particular significance is the space and weight saving resulting from the elimination of the transformer. A descriptive brochure is available upon request.

TV Picture Straightener

GLASER-STEERS CORP., 2 Main St., Belleville 9, N. J., has introduced a magnet assembly for correcting a pin-cushioning effect caused by the deflection yoke and the curvature of the tube face. From one to four of these assemblies are used, depending upon the amount of distortion. The units are mounted on the conical section of the tube forward of the deflection yoke. The device is especially effective when used

JOHNSON miniature air variables

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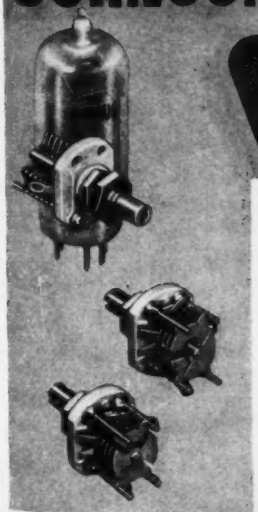
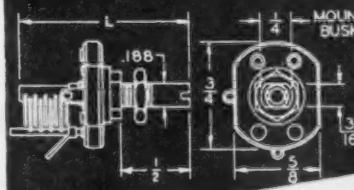


Requiring a panel area just ⅝" wide by ¾" high, these diminutive capacitors provide the answers to many problems encountered in the design of compact radio frequency equipment.

JOHNSON Miniature Air Variables are available in three types: single section, differential and butterfly. Ideally suited for portable, mobile and airborne equipment thru the VHF range of frequencies, they are designed and constructed with features that assure reliable performance throughout long service life.

Features

• Low inductance • Soldered plates assembled with precision tools • Split sleeve bearings • Beryllium copper tension spring contact for permanent alignment, constant torque and low inherent noise • Differential and butterfly types electrically symmetrical • Excellent vibration characteristic due to low inertia • Steatite insulation impregnated with DC-200 • Metal parts brass, nickel plated • Single hole mounting bushing threaded 1/4-32 with flats to prevent turning • 3/16" shaft slotted for screw driver adjustment • Plate spacing .017" • Peak voltage rating, 1250



JOHNSON Catalog 701, yours for the asking, describes this miniature line as well as other JOHNSON Variable Condensors.

JOHNSON Miniature Air Variables are available in production quantities with features such as: 1. Locking bearing. 2. With 180° stop. 3. Various shaft extensions. 4. .0135" spacing offering capacities up to 30 mmfd. 5. High torque.

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9M11	8.7	1.8	9	1- 7/32
15M11	14.2	2.3	15	1-13/32
20M11	19.6	2.7	21	1-37/64
	DIFFERENTIAL			
6MA11	5.0	1.5	7	1- 7/64
9MA11	8.7	1.8	13	1- 7/32
15MA11	14.2	2.3	22	1-13/32
19MA11	19.6	2.7	31	1-37/64
	BUTTERFLY			
3MB11	3.1	1.5	7	1- 7/64
5MB11	5.1	1.8	13	1- 7/32
9MB11	8.0	2.2	22	1-13/32
11MB11	10.8	2.7	31	1-37/64

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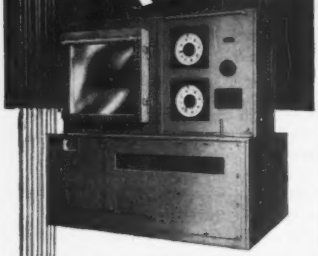

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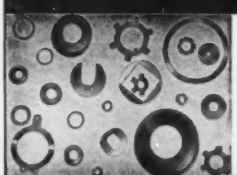

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with the cylindrical faced tube. Adjustment is easily made by varying the distance from the magnet to the tube axis.

Miniature Ceramic Capacitors

ERIE RESISTOR CORP., Erie, Pa., has announced a new line of miniaturized tubular ceramic capacitors, the GP3 Ceramicons. They employ a high dielectric constant ceramic material with which capacitance values as high as 0.002 μf are available on a basic $\frac{1}{4} \times \frac{3}{8}$ in. long tube, and 0.005 μf on a $\frac{1}{4} \times \frac{5}{8}$ in. long tube. Available on special order since 1949 they are now made in volume production quantities. The units are flash tested at 1,500 v d-c and are designed to withstand 700 v d-c life test at 85 C for 1,000 hours. Standard capacitance tolerance is + 80 percent, − 20 percent and power factor is 2.5 percent maximum.

Sealed Panel Instrument

WESTON ELECTRICAL INSTRUMENT CORP., 641 Frelinghuysen Ave., Newark 5, N. J. Model 1329 $2\frac{1}{2}$-in d-c and a-c rectifier-type panel instrument has a scale of 3.7 in. over a 250-deg deflection. The six mounting holes provided permit tight sealing of the instrument to the panel. The instrument is magneti-

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cally shielded; has a zero corrector in the base, or rear; and the accuracy rating on d-c is 2 percent.

Moisture Meter

TAGLIABUE INSTRUMENTS DIV., Weston Electrical Instrument Corp., 614 Frelinghuysen Ave., Newark 5, N. J. Model 8008 Moisturonic moisture meter, a portable instrument featuring an overall range of from 2,000 ohms to 20,000 megohms, measures the moisture content of lumber, wood, plaster, and many other materials of varying textures and consistencies. The instrument is available in two forms: one with a scale calibrated for use with lumber, wood and plaster and the other with linear graduations for use with materials for which no calibrations have been determined. Both versions are available as either battery operated for use anywhere, or are furnished to operate on 115 v, 60 cycles a-c.

Literature

D-C Winding-Insulation Tester. General Electric Co., Schenectady 5, N. Y. Bulletin GEC-794 describes a d-c winding insulation tester for testing d-c armatures, series field coils and low-impedance a-c stator coils. Illustrations of the unit, its chief advantages, operating instructions and specifications are given.

Audio Amplifier. Waveforms, Inc., 333 Sixth Ave., New York 14, N. Y. A recent four-page folder de-

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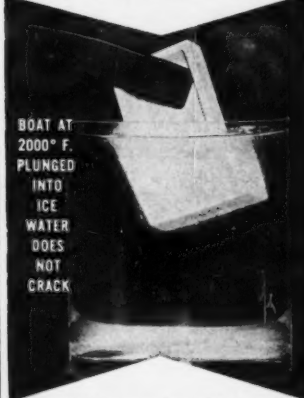

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scribes and illustrates the A-20-5 ultrahigh fidelity remote-control audio amplifier, featuring a continuously variable treble cutoff filter. Chief features and applications, photographs and characteristics charts are shown. Technical specifications are included.

Instrumentation Bulletin. Berkeley Scientific Corp., Richmond, Calif., has issued an 8-page bulletin illustrating and describing a cross-section of a complete line of standard instruments. Included are electronic counters, events-per-unit-time meters, time interval meters, preset counters, auxiliary electronic devices, nuclear scalers, count rate meters, counting rate computers, hand and foot monitors and single or double pulse generators.

Servomechanism Techniques. Minneapolis-Honeywell Regulator Co., Brown Instruments Division, Wayne and Windrim Ave., Philadelphia 44, Pa. Practical applications of servomechanism techniques to a process control problem are described in a 20-page bulletin—ISA paper No. 51-8-2. The paper reviews progress in analysis of automatic control problems and illustrates a new technique exemplified by solutions to a typical flow control problem.

H-F Generators. Bogue Electric Mfg. Co., 50 Iowa Ave., Paterson 3, N. J., recently issued bulletin 440 dealing with 400-cycle power supplies designed for operation of all types of high-speed machine tools, testing of precision electronic equipment, testing and proving radar and aircraft equipment, operation of high-frequency motors, marine and aircraft power supplies, high-quality laboratory power supplies and many other uses. A line of 400-cycle generators and motor generator sets, available from 100-w output to 600-kw output, either single or three phase, is described.

Ultralow-Torque Potentiometers. Electro-Mec Laboratory, 19 Murray St., New York 7, N. Y., has published a 4-page folder for loose-leaf binding, describing and

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DIVISION OF THE NATIONAL RADIATOR COMPANY
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illustrating the type 1395 precision ultralow-torque potentiometers that are designed for use as transmitters in indicating or control (servo) circuits. The units described are used to convert small mechanical movements of very low force into equivalent voltages, the high electrical output usually being sufficient without further amplification. Complete technical specifications are included.

Subfractional H-P Motors. Air Marine Motors, Inc., 2183 Jackson Ave., Seaford, L. I., N. Y., has available a pamphlet covering subfractional horsepower motors, their end applications and selection. The publication was prepared with an eye toward discussing the problems pertaining to design and use of subfractional h-p motors in as complete a manner as possible without being too technical to reach and educate personnel unfamiliar with the more important aspects of problems in the rotary equipment field.

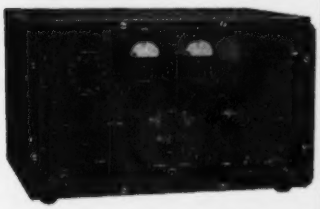
TV Picture Tubes. National Union Radio Corp., Orange, N. J., has available two data sheets dealing with the 21EP4A magnetically-focused magnetically-deflected and the 21FP4A electrostatically focused magnetically deflected tv picture tubes. Data given include general characteristics, maximum ratings, typical operation, maximum circuit values and mechanical information.

C-D Communication Equipment. General Electric Co., Syracuse, N. Y., has issued a folder containing eight technical data sheets on two-way f-m radio communication equipment for civil defense. Illustrated descriptions and specifications are included for remote dispatch units, a variety of station combinations, model 204 mobile combination, a selective dispatching system and two types of civil defense receivers. Other technical data sheets may be added to the folder as they are published.

Vibration Discriminator. Lion Mfg., Inc., P. O. Box 1348, Columbus, Ohio. The model AFS-101 vibration discriminator discussed

Check up ✓ CHECK OUT

WITH SIGNAL GENERATORS by AIRCRAFT RADIO Corporation



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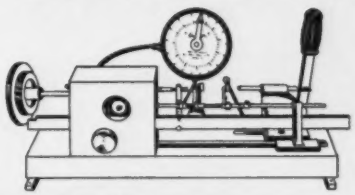

The MODEL W

Compare..COMPARISON WILL SHOW THAT THE MODEL W is:

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- more CONVENIENT—easy to set up

PRICED RIGHT!

Most versatile of all models is our Model W which is widely used in schools and laboratories. With a few simple accessories this machine will wind virtually every coil used in the electrical and electronics industries. Write for detailed listing and description.

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DX XTALS
THE HEART OF A GOOD TRANSMITTER

-and dish it out!

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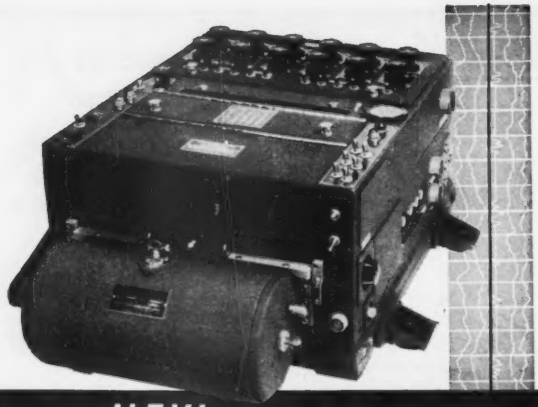

the *NEW* S-8 Oscillograph

Here, in a versatile instrument of advanced design, are all the things you need for complete oscillographic recording. The Hathaway Type S-8 Oscillograph, which has long been the standard of oscillographic recording, has been improved to meet the rapidly expanding demands of modern research. Whether your measurement problems are simple or complex, the NEW Type S-8 Oscillograph has the inherent capabilities necessary to measure vibration, pressure, acceleration, and strain with new ease and accuracy.

The newest features include:

QUICK-CHANGE TRANSMISSION *fully enclosed with gears running in oil* **to provide instantaneous selection of 16 record speeds over the range of 120:1**

CHART TRAVEL INDICATOR provides continuous indication of chart motion. Operator knows instantly by flashing lamp if anything should happen to interfere with chart motion

FULL-RESILIENT MOUNTING FOR MOTOR AND TRANSMISSION isolates all possible vibration and makes possible the use of modern super-sensitive galvanometers

NEW GALVANOMETER STAGE accommodates *all* Hathaway galvanometer for recording milliamperes, microamperes, or watts

NEW RECORD-LENGTH CONTROL AND NUMBERING SYSTEM designed for long, trouble-free service under all kinds of ambient conditions

All the other valuable features are retained, such as

PRECISION TUNING-FORK-CONTROLLED TIMING SYSTEM produces either 1/10-second or 1/100-second time lines across sheet

WIDE RANGE OF GALVANOMETER TYPES AND CHARACTERISTICS provide for almost any recording requirements. Natural frequencies to 10,000 cps. Sensitivities to 50,000 mm per ma, single and polyphase watts

DAYLIGHT LOADING AND UNLOADING RECORDS TO 200 FT. IN LENGTH, width to 10 inches

SIMULTANEOUS VIEWING AND RECORDING

AUTOMATIC BRILLIANCY CONTROL

12 TO 92 ELEMENTS

Whatever your needs may be, investigate the NEW Type S-8 Oscillograph and its 170 types of galvanometers — the most versatile equipment in existence for general-purpose applications.

***WRITE FOR BULLETIN* 2B1-A-G**

Hathaway
INSTRUMENT COMPANY
1315 SO. CLARKSON STREET • DENVER 10, COLORADO

in a recent circular is part of the company's new line of vibration analyzing equipment. Complete technical specifications of the unit and its accessories, as well as an illustrated description are included. Prices, terms and warranty information are also given.

Engineering Information Service. Sylvania Electric Products Inc., 1740 Broadway, New York 19, N. Y. The first issue of a new engineering information service bulletin contains articles on (1) a 500-mc noise generator for uhf tv which uses a type 5722 noise diode, and (2) the type 300 oscilloscope calibrating standard. This engineering information service will come in the form of a periodic release suitable for binding and preserving for future use as a reference medium.

Time Delay Relay. Heinemann Electric Co., Trenton 2, N. J. Bulletin 5001 deals with the Silic-O-Netic time delay relay, a hermetically sealed time element for small size, low cost and absolute dependability. Illustrations, chief features, operating characteristics, general specifications and ordering information are given.

Precision Potentiometers. DeJur-Amsco Corp., 45-01 Northern Blvd., Long Island City 1, N. Y. Catalog E-L covers a complete line of series L-400 precision wirewound potentiometers. Complete specifications are furnished in four pages for these small-size, highly accurate potentiometers showing a wide variety of applications for single and multiple-ganged units.

Industrial Retaining Rings. Industrial Retaining Ring Co., 8 W. Sidney Ave., Mount Vernon, N. Y., has available a bulletin dealing with its industrial retaining rings that are stacked for modern dispensing and speedy application. The rings described are made from carbon spring steel, heat-treated to exacting specifications, and provide shoulders on grooved, circular shafts. Included with the bulletin is an engineering specifi-

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ELECTRONIC ENGINEERS

WHO WE ARE:

As a result of our recent affiliation with the Westinghouse Airbrake Co., we are entering a new and accelerated expansion program directed toward permanent growth in the industrial electronics field.

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FIND OUT TODAY. Illustrated bulletin with complete technical data will be sent on request.

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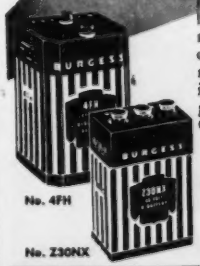


No. 4FH

No. Z30NX

WRITE FOR ENGINEERING MANUAL AND CHECK SHEET—No obligation. By return mail you will receive the FREE Engineering Manual listing the complete line of Burgess Batteries together with detailed specifications; also the Burgess "Check Sheet" on which you may outline your battery requirements in the event that the battery you need has not already been developed. Address:

BURGESS BATTERY COMPANY
(DEPT. E-6) FREEPORT, ILLINOIS

Military Tube Sockets

In addition to meeting applicable JAN specifications, METHODE sockets and accessories for military applications are manufactured with all the EXTRA quality, precision and care which can go into a compact heavy duty wiring device.

With test failures and component rejections so costly now, the many extras, standard with METHODE, and the uniformity assured by perfected quality control techniques worked out in conjunction with the services are saving users many headaches.

Following are standard JAN specifications to which METHODE is currently producing:

DESCRIPTION	JAN S-28A AMEND. 1 (2-19-51)	JAN S-28A (2-28-49)	JAN S-28 (8-31-44)	KEY DIMENSIONS
Miniature 7 Pin Plastic Socket	TS102P01	TSE7T101	S010M S011M	Mtg. Centers 7/8"; Mtg. Holes 1/8"; Chassis Hole 5/8".
Miniature 7 Pin Ceramic Socket	TS102C01	TSE7T102	S010C S011C	Mtg. Centers 7/8"; Mtg. Holes 1/8"; Chassis Hole 5/8".
Noval 9 Pin Plastic Socket	TS103P01	TSE9T101		Mtg. Centers 11/8"; Mtg. Holes 1/8"; Chassis Hole 3/4".
Noval 9 Pin Ceramic Socket	TS103C01	TSE9T102		Mtg. Centers 11/8"; Mtg. Holes 1/8"; Chassis Hole 3/4".
Miniature 7 Pin Tube Shield	TS102U01	TSF0T101	SOS 3	Height 1 3/8"
Miniature 7 Pin Tube Shield	TS102U02	TSF0T102	SOS 6	Height 1 3/4"
Miniature 7 Pin Tube Shield	TS102U03	TSF0T103		Height 2 1/4"
Miniature 9 Pin Tube Shield	TS103U01	TSF0T104		Height 1 1/2"
Miniature 9 Pin Tube Shield	TS103U02	TSF0T105		Height 1-15/16"
Miniature 9 Pin Tube Shield	TS103U03	TSF0T106		Height 2 3/8"

Plastic insulators in above sockets are Type MFE, phenolic, per MIL P-14A. Ceramic insulators are steatite, Grade L-4B or better per JAN 1-10. Contacts are silver plated copper base alloy (phosphor bronze and beryllium where specified) with terminals hot tin dipped. Shields and bases on JAN S-28 units are steel cadmium plated; S-28A and Amendment 1 parts use brass, nickel plated.

Crystal Socket

A number of METHODE products not as yet covered by JAN specifications are finding application in military equipments, such as the two prong crystal socket for holders with .050" pins on .486" centers shown. Consult METHODE for standard type sockets with special materials and performance incorporated for military applications.

Inquiries are invited.

METHODE Manufacturing Corp.

2265 West St. Paul Avenue • Chicago 47, Illinois

Geared to produce Plastic and Metal Electronic Components

cation data sheet showing shaft size, ring dimensions and groove dimensions for the entire line.

Phono Pickup. Lindberg Instrument Co., 830 Folger Ave., Berkeley 10, Calif., has available a pamphlet introducing Fluid Sound, a new phono pickup using fluid-damping and fluid-coupling. The pickup described does not require the stylus to do the work of generating the output voltage and is almost entirely free from hum pickup. Dimensional drawings and technical data are included.

Induction Heating. Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa., has available the 12-page booklet B-4782 that presents case histories of how induction heating has increased production 50 to 2,000 percent, reduced space up to 90 percent and cut production costs. Modern induction heating apparatus — generators and work handling equipment—are described as machine tools for hardening, heating, annealing or joining metals in mass or batch quantities.

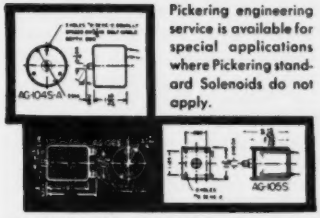
Control Instruments. Assembly Products, Inc., Chagrin Falls, Ohio. Catalog No. 1A contains twelve bulletins dealing with a line of pyrometer controls and contact meter relays for operation and process controls. Technical data, illustrations, ordering information and price lists are given. Also included are a list of users and an extra bulletin on the model 351-5 millivoltmeter for checking thermocouple controls and the model 1654-A Simplytrol oven thermomenter.

Carbon and Graphite Products. National Carbon Co., A Division of Union Carbide and Carbon Corp., 30 E 42nd St., New York 17, N. Y. Products made in carbon and graphite in grades from porous to impervious for applications in the chemical and process, metallurgical, mechanical and electrical fields are fully described in the 20-page catalog section S-5005. Principal features of the products described are: resistance

PICKERING

SOLENOIDS

For DC Circuits



Pickering engineering service is available for special applications where Pickering standard Solenoids do not apply.

For details and literature address Department N

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This new material packs 1000 ohms cmf—48% more than the widely-used nickel-chromium alloys.

And what's more, there's no loss of other important physical and electrical properties. High tensile strength—excellent solderability—TC of Resistance is 20—EMF vs Copper + 7 micro-volts—Coefficient of Expansion 13.9—remarkable Surface-Corrosion Resistance—and many more vital characteristics make ALLOY 1000 a money-making prestige-building component of compact, precision resistors. For complete data, get Bulletin 17

ELECTRONICALLY REGULATED

LABORATORY POWER SUPPLIES

BENCH MODEL 25

- STABLE
- DEPENDABLE
- MODERATELY PRICED

- **INPUT:** 105 to 125 VAC. 50-60 cy
- **OUTPUT #1:** 200 to 325 Volts DC at 100 ma regulated
- **OUTPUT #2:** 6.3 Volts AC CT at 3A unregulated
- **RIPPLE OUTPUT:** Less than 10 millivolts rms

WIDTH 14"
DEPTH 6"
HEIGHT 8"
WT. 17 LBS.

For complete information write for Bulletin E

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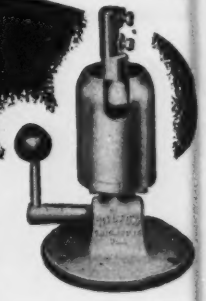
FLUSHING NEW YORK

Cut Your Costs, Too, With

POWRARM WORK POSITIONERS



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POWRARM cuts costs by increasing every worker's productivity. It gives the worker a powerful *third hand* to hold work while two hands produce. That's why POWRARM works on the most efficient assembly lines in America today, and *belongs on yours.* Write us about your production "headache" . . . we'll show you how POWRARM can cure it.

Holds work at any angle in Horizontal, Vertical or Co-axial Plane.

Three sizes of Powrarm—24 to 150 lbs. capacity.

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32 informative pages, FREE

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Precision Built Bench Vises, "C" Clamps and Work Positioners

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MEASURING EQUIPMENT

Complete Frequency Coverage -- 14kc to 1000mc!

NM - 10A VLF

14kc to 250kc

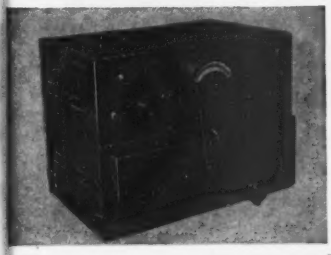
Commercial Equivalent of AN/URM-6.

Very low frequencies.

HF NM - 20A

150kc to 25mc

Commercial Equivalent of AN/PRM-1. Self-contained batteries. A.C. supply optional. Includes standard broadcast band, radio range, WWV, and communications frequencies.

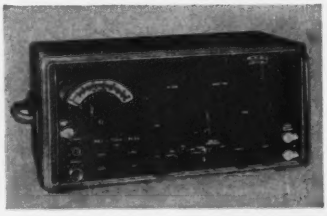


NMA - 5A VHF

15mc to 400mc

Commercial Equivalent of TS-587/U.

Frequency range includes FM and TV Bands.



UHF NM - 50A

375mc to 1000mc

Commercial Equivalent of AN/URM-17.

Frequency range includes Citizens Band and UHF color TV Band.

These instruments comply with test equipment requirements of such radio interference specifications as JAN-I-225a, ASA C63.2, 16E4(SHIPS), AN-I-24a, AN-I-42, AN-I-27a MIL-I-6722 and others.

STODDART AIRCRAFT RADIO CO.

6644 SANTA MONICA BLVD. HOLLYWOOD 38, CALIFORNIA

Hillside 7294

to practically all corrosive chemicals, high heat transfer of graphite products and low heat transfer of carbon products, ease of machining and fabrication, resistance to severe thermal shock, low thermal expansion, strength maintained with no deformation at high temperatures and good electrical conductivity.

Magnetic Recording. Audio Devices, Inc., 444 Madison Ave., New York 22, N. Y., has available a booklet written by its vice-president, C. J. Lebel, entitled "Fundamentals of Magnetic Recording." Its 50-odd pages include such topics as: a brief history, tape vs wire, magnetic recording method, magnetic relations, bias, erasing, output, frequency response, distortion and noise, modulation noise, tape construction, hints on selecting a tape recorder, maintenance, recording time for various tape speeds and reel sizes, and technical data on Audiotape.

Station Planning. Allen B. DuMont Laboratories, Inc., Clifton, N. J., has published a booklet on station planning, a complete step-by-step outline directed to management and station engineers which fully explains the facilities and function of all equipment necessary to the normal operation of a well-integrated tv station. Equipment layouts suggested provide for future expansion of these facilities. Easy-to-understand renderings along with exploded views and systematic floor plan arrangements follow the text graphically. As the reader goes through the booklet he finds a complete breakdown for each equipment complement explaining the actual equipment pieces and approximate costs of the various units incorporated in that group. The booklets will be forwarded directly to all tv managers and station engineers requesting copies on their company letterheads.

Precision-Regulated Power Supply. Pedersen Electronics, Lafayette, Calif. A single-page bulletin covers the model 300 precision-regulated power supply that fea-

TEFLON MAGNET WIRE

FOR HIGHEST TEMPERATURE APPLICATIONS

Warren Wire Company is now producing in quantity Teflon insulated Magnet wire.

SIZES—14 through 45
Single, Heavy, Triple and Quadruple thickness, NEMA STANDARDS

We invite inquiries where requirements call for:

small SPACE FACTOR
HIGHEST ABRASION RESISTANCE
FLEXIBILITY AND ADHERENCE
DIELECTRIC STRENGTH
RESISTANCE TO CHEMICALS

and it will withstand temperatures of 250 centigrade.

WARREN WIRE COMPANY,

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Model 1

Convenient Height and Viewing Angle
Adjustable to Hold Portable Scopes
Ball Bearing Swivel Rubber Tired Casters
Lightweight Aluminum Construction
Recommended by Laboratories Wherever Used

$35.00 FOB LOUISVILLE, KY.

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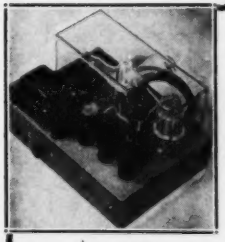

SERIES "S"
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Voltage Ranges to 60,000 Volts

INQUIRIES INVITED REGARDING YOUR REQUIREMENTS

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HERMETICALLY SEALED RELAYS

Meet AN Standards or Armed Services Applications

Compact, multiple contact... vibration and shock proof. Built to meet rigid specifications and severe operating conditions.

Unique pile up arrangement reduces over-all space compared with conventional relays.

Octal base, snap-on dust cover or hermetically sealed. Also AN connector.

SERIES 80
MIDGET TELEPHONE TYPE RELAYS

NEW CONTAINER SAVES SPACE

Hermetically sealed header type: 2" h. above mounting surface, x 1⅛" w. x 1" d.

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Engineering Representatives in Principal Cities

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Gentlemen:
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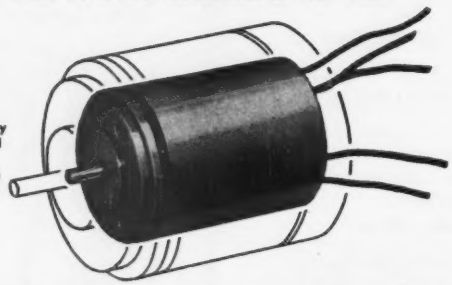
ECLIPSE-PIONEER

Announces the New Line of

PYGMY SYNCHROS



Size of pygmy as compared to AY-200 series outline

Eclipse-Pioneer has added a tiny new member to its great family of famous Autosyn* synchros. It's the new AY-500 series, a precision-built pygmy weighing only 1¼ oz. while scaling only 1.278" long and .937" in diameter (the same diameter, incidentally, as a twenty-five cent piece). Its accuracy and dependability are assured, thanks to Eclipse-Pioneer's 17 years of experience and leadership in the development of high precision synchros for aircraft, marine and industrial applications. For more detailed information on the AY-500 and other E-P Autosyns, such as the remarkably accurate AY-200 series (guaranteed accuracy to within 15 minutes on all production units), please write direct to Eclipse-Pioneer, Teterboro, N. J.

*REG. TRADE MARK BENDIX AVIATION CORPORATION

LOOK FOR THE PIONEER MARK OF QUALITY REG. U.S. PAT. OFF.

Typical Performance Characteristics

	One AY-201-3 Driving		One AY-500-3 Driving
	One AY-500-3 Control Transformer	Two AY-500-3 Control Transformer	One AY-500-3 Control Transformer
INPUT			
Voltage	26-volts, single-phase	26-volts, single-phase	26-volts, single-phase
Frequency	400 cycles	400 cycles	400 cycles
Current	88 milliamperes	110 milliamperes	55 milliamperes
Power	0.8 watts	1.2 watts	0.9 watts
Impedance	105+j280 ohms	100+j220 ohms	290+j370 ohms
OUTPUT			
Voltage Max. (rotor output)	17.9 volts	16.2 volts	14.1 volts
Voltage at null	40 millivolts	40 millivolts	40 millivolts
Sensitivity	310 millivolts/degree	280 millivolts/degree	245 millivolts/degree
Voltage phase shift	23 degrees	26 degrees	44 degrees
System accuracy (max. possible spread)	0.6 degrees	0.6 degrees	0.75 degrees

Other E-P precision components for servo mechanism and computing equipment:

Servo motors and systems • rate generators • gyros • stabilization equipment • turbine power supplies • remote indicating-transmitting systems and special purpose electron tubes.

For detailed information, write to Dept. C

ECLIPSE-PIONEER DIVISION of

TETERBORO, NEW JERSEY

Bendix AVIATION CORPORATION

Export Sales: Bendix International Division, 72 Fifth Avenue, New York 11, N. Y.

tures low source impedance, utmost stability under a wide variety of load conditions, minimum ripple and negligible drift. Operating data, specifications, size, weight and prices are included.

Pure Ferric Oxides. C. K. Williams & Co., Easton, Pa., has available a data sheet on the properties of the three most popular pure red iron oxides. Actually, the company has 10 different grades but the three described will cover 98 percent of the application. Particle size, physical properties and chemical analysis are given.

Electronic Contour Follower. General Electric Co., Schenectady 5, N. Y. has announced a new four-page bulletin on electronic contour follower systems for machining irregularly shaped parts. The publication, designated as GEA-5660, covers one-, two- and three-dimension tracer control systems for use on lathes, boring mills, milling machines, drilling machines and the like. Employing many photographs and diagrams it gives a brief description of each of the systems, its components, features and operation.

Measuring Instruments. Dawe Instruments Ltd., 130 Uxbridge Road, Hanwell, London W.7., England, has issued a 6-page illustrated brochure summarizing a wide range of electronic measuring equipment manufacturing. Technical data are given for instruments for the radio and communications laboratory, as well as instruments for industrial and photographic applications.

Time Delays. Diaphlex, Div. of Cook Electric Co., 2700 North Southport Ave., Chicago 14, Ill., has published a 12-page booklet dealing with a wide line of Tarrytron time delays. Illustrations, dimensional drawings and technical specifications for each are included. Ordering information is made easy.

Miniature Wire and Cable. Tensolite Insulated Wire Co., Inc., Tarrytown, N. Y. Engineering and manufacturing facilities for miniature insulated stranded wires and tin-

Specify... GM

D'ARSONVAL PORTABLE

GALVANOMETERS

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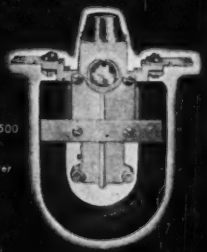

Series 570-500 Mirror-Type D-C Galvanometer

Ideal as a built-in component of other instruments—with the sensitivity and ruggedness that is especially desirable for Colorimetry, Densitometry, and various other measurements. Unit includes mirror movement, magnet and zero correction knob. Choice of 4 standard models.

Write us about your application and requirements

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WINCHESTER ELECTRONICS, INCORPORATED

NEW MINIATURE CONNECTORS

CPRM5-2P (Pin Contacts in Panel Mounted Shell)

CPRM5-2S (Socket Contacts in Cable Mounted Shell)

... for Airborne Electronic Equipment designed and manufactured by Winchester Electronics, Inc.

Recent designs for electronic equipment in aircraft and guided missiles have required progressive miniaturization of electronic components. The above connector is typical of several recent designs we have supplied to meet this need. We have given special consideration to the following features:

1. ***Shell Enclosure*** — Die cast aluminum alloy.
2. ***Light Weight*** — Total for plug and receptacle 1.5 oz.
3. ***Small Size*** — Maximum diameter 1". Total length O.A. 1⅞".
4. ***Right Angle Cable Entry*** — For use in limited space.
5. ***Pressure Tight*** — Inserts, contacts and cable entry, individually sealed with neoprene "O" rings or special gaskets.
6. ***Contacts***—Five for #20 A.W.G. and two for #18 A.W.G. wire.
7. ***Finish*** — Olive drab, iridite.

Other contact arrangements and shell designs will be available soon — Write our Engineering Department for complete details.

These connectors also employ standard Winchester Electronics features:

1. MONOBLOC* construction.
2. Molded Melamine (mineral filled) inserts.
3. Precision machined pin and socket contacts, silver plated with gold flash over.

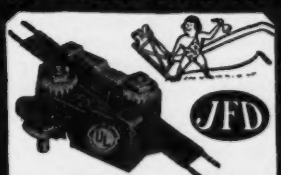
*Trade Mark.

Let us help you with your difficult connector problems. Advise us of your special requirements.

WINCHESTER ELECTRONICS INCORPORATED

GLENBROOK, CONN., U.S.A.

PERFORMANCE
Not Size
IS WHAT COUNTS



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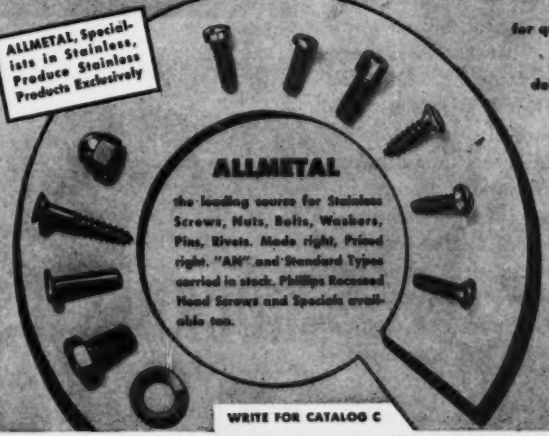

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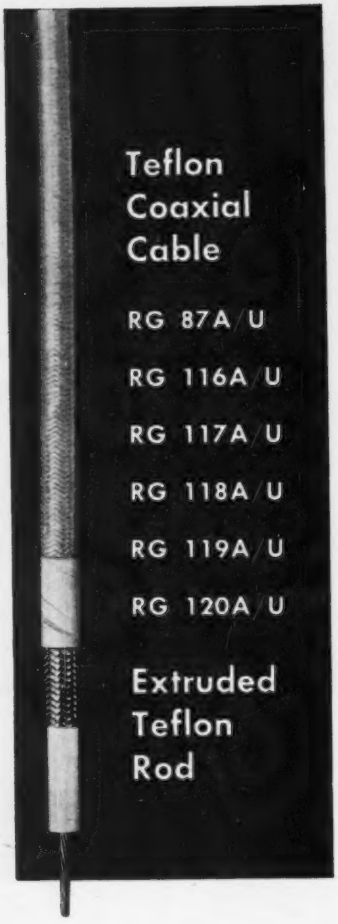

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sels, including a wide variety of wire and cable constructions, are discussed in a recent folder. Product classifications and engineering data are given. Four sheets of technical information on standard Tensolite flexible wires and cable are included.

Gas Dust Analyzer. Minneapolis-Honeywell Regulator Co., Brown Instruments Division, Wayne and Windrim Ave., Philadelphia 44, Pa. Instrumentation Data Sheet No. 10.14-6 gives an illustrated technical description of a gas dust analyzer that operates with an Electronic potentiometer to provide continuous record of dust content. Operation and application data are included.

Mechanical Interlock. Simonds Machine Co., Inc., Southbridge, Mass. The many improved features of the new Linemaster Lektro-Lek switch are fully described in a recently issued bulletin. The mechanical interlock described which works on the seesaw principle with selective circuits, prevents both circuits from being operative at the same time; its single cord receptacle eliminates costly harness assemblies and all wiring connections are made internally. The device treated is particularly suited for sound transmission equipment such as wire or disc recorders, raising and lowering of appliances and intercommunication systems.

Pocket-Size Test Instrument. Pyramid Instrument Corp., 49 Howard St., New York 13, N. Y. Case histories of electricians, maintenance men, service men, engineers, and production and test personnel who do their servicing with the aid of an Amprobe Snap-around volt ammeter have been gathered into the 16-page manual No. 504. Eleven case histories in the booklet illustrate as many different uses. A working drawing of the Amprobe with its specifications and mechanical dimensions is shown.

Sonometer. Electro Products Laboratories, Inc., 4501 Ravenswood Ave., Chicago 40, Ill., has issued a single-sheet bulletin on the model 4100 sonometer, an instrument

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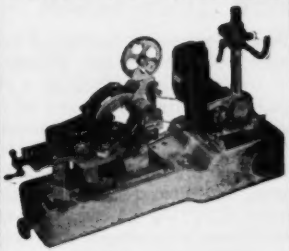

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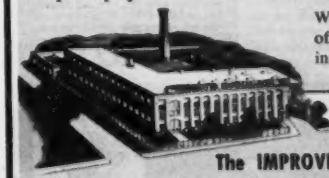

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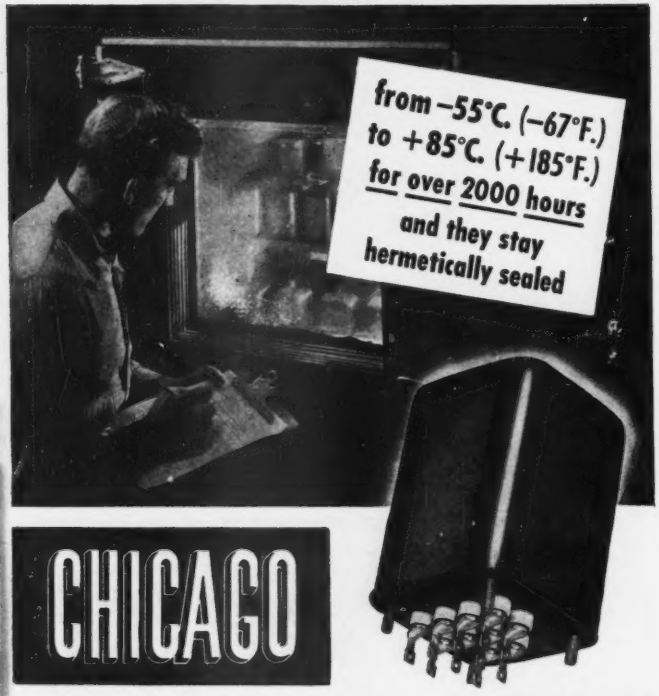

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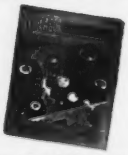

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used for determining the resonant frequency of any solid mass or material where strength is an important factor. Exclusive features, specifications and some typical applications are described and illustrated.

Sound Equipment. Bell Sound Systems, 555 Marion Road, Columbus 7, Ohio. Catalog 5152 gives a 20-page illustrated description of an extensive line of sound equipment. Topics listed in the general index include: high-fidelity amplifiers; tape and disc recording equipment; 10, 15, 25 and 50-watt amplifiers; p-a systems; inter-communication equipment; and accessories.

Variable Ratio Speed Changer. Metron Instrument Co., 432 Lincoln St., Denver 9, Col. Technical data sheet No. 4C page 1 discusses a miniature variable speed drive with push rod ratio control. Applications of the unit described include timers, recorders, controllers, computers, indicating mechanisms and similar low power devices requiring remote or automatic control.

Wire-Wound Resistors. Cubic Corp., 2841 W. Canon, San Diego 7, Calif. A single-sheet bulletin deals with a line of circular form wire-wound resistors, originally developed for use as signal pickoff devices for servomechanisms, but which may find use in many other applications. Typical example types are shown and specifications are given.

Industrial Tape Uses. Polyken Industrial Tape, Dept. of Bauer & Black, 222 W. Adams St., Chicago 6, Ill., has just released the Polyken Standard Industrial Classification Manual. Nearly 80 pages in length, it contains 21 major group classifications (based on the U. S. census breakdown), 175 detailed industry classifications, and approximately 1,500 distinct and specific uses for industrial tape. A variety of tape numbers, widths and applications for communications equipment and related products, radio and radar equipment and tv equipment are listed.

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(continued from page 150)

an approaching enemy plane. Thus the jet fighter pilot of tomorrow will not only learn how to handle his plane without taking it off the ground, but also how to bag an enemy plane as it approaches him at the speed of sound.

The electromechanical trainer contains 1,152 electronic tubes, 60 miles of wiring, takes up 600 feet of floor space and stands 10 feet high. Over 100,000 engineering hours went into its design and it will take between 500 and 600 printed handbook pages to explain its operation and design.

Its cockpit will duplicate in every detail that of the F-86D Sabre. Heart of the trainer, and separate from the cockpit, is a battery of analog computers. Out of them come the answers to how the pilot "flew the plane." If the pilot makes a mistake the computers automatically change the cockpit instrument readings to conform to the actual conditions. Unless the pilot corrects a mistake, the conditions will automatically carry through to its logical end, which may well be a fatal crash.

The Sabre simulator requires two instructors, one for flight performance and the other for radar operations. The latter also controls the simulated target, or enemy plane, which the pilot is required to attack.

Sarnoff Fellowship Established

A PREDOCTORAL fellowship in electrical engineering, providing an annual grant of $2,700, was established by the Radio Corp. of America last month in the College of Engineering at New York University. The award will be known as the David Sarnoff Fellowship in honor of the chairman of the board of RCA. Selection of the first student to receive the fellowship will be made in February 1952.

Other RCA resident fellowships are available for outstanding graduate students in electrical engineering at Princeton University, California Institute of Technology and University of Illinois. In each university the selection is made jointly

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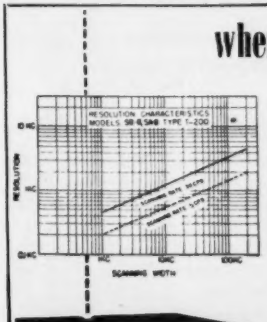
SIGNAL RESOLUTION IS A "MUST"...SO ARE



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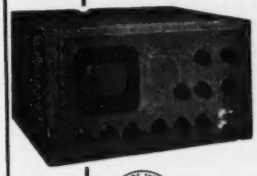

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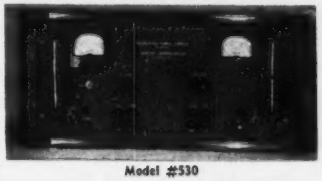

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Output: 80 to 350 volts D.C. @ 275 ma. regulated.
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6.3 volts at 10 amps., C.T. unregulated
Hum: less than 5 millivolts
Regulation: Better than ½% from no load to full load

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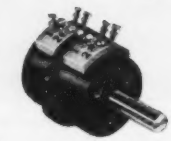
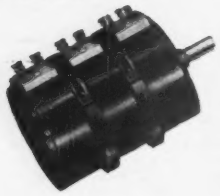
In spite of their thumbnail size the RV ⅞ and the RV 1-1/16 are precision, high linearity variable resistors, (or adjustable trimmers) of high stability — achieving a standard of performance hitherto unavailable in such miniature potentiometers.

Construction features include: precision machined aluminum base . . . low torque . . . all soldered connections except sliding contacts . . . paliney contacts can be sealed to withstand all humidity, salt spray and altitude specifications. Ganging if desired with TIC adjustable clamp ring.

RV ⅞" available with linear resistance elements *only* — nine standard resistance values from 100 to 25,000 ohms. Power rating 6 watts at 25°C. Illustration shows RV ⅞ with threaded bushing . . . servo mounting available if desired.

RV 1-1/4" available with linear or non-linear resistance elements — nine standard resistance values from 100 to 50,000 ohms. Illustration shows RV 1-1/16 with 3 tapped hole mounting . . . servo mounting or threaded bushing if desired.





Type RV1⅛" and RV2" High Precision Potentiometers . . . semi-standardized types of precision machined aluminum base potentiometers with exceptionally high electrical accuracy and mechanical precision. For both linear and non-linear functions. Designed for precision instrument, computer and military applications. Accurate phasing of individual units possible with clamp-ring method of ganging.
Ball bearing models available.

*Numbers refer to diameter of bases.

Tapped mounting inserts
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Totally enclosed with cover
"Constrict-O-Grip" clamping to shaft —(no set screws)
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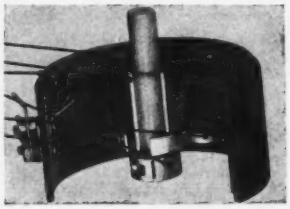
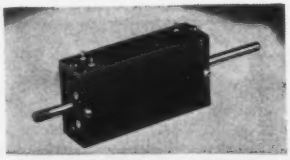


Sine and cosine potentiometers available in RVP3* and RV2* bases.

Type RV3" Bakelite Base Precision Potentiometers . . . available in models for either linear or non-linear functions. Stock resistance values ranging from 100 Ω to 200,000 Ω and power ratings of 8 and 12 watts. 360° mechanical rotation or limited by stops as desired. Potentiometers of this type available to widely varying accuracy requirements (linearity to ±0.25%) — see TIC Bulletin RV3-250. Special models available for high humidity applications.

Type RVP3" High Precision machined aluminum base Potentiometers . . . available in models for either linear or non-linear functions with standard resistance values up to 200,000Ω. Linearity to ±0.1%. Eleven gang assembly available, example of TIC's potentiometers multi-ganged with TIC's adjustable clamp ring. Can be supplied to meet various mounting requirements — single hole, 3 tapped hole mounting or servo mounting as desired.

Type RVT Translatory Potentiometers . . . actuated by longitudinal instead of rotary motion providing linear electrical output proportional to shaft displacement. Used as a position indicator, high amplitude displacement type pickup and for studying low frequency motion or vibration. Features exceptionally high linearity and resolution. Available in various lengths and resistance values.



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by the academic officers and the RCA education committee.

IRE Elections and Awards

AT an IRE board of directors meeting held in November election of the following officers and directors was announced:

President, 1952—Donald B. Sinclair of General Radio Co., Cambridge, Mass.

Vice-president, 1952—Harold L. Kirke of the British Broadcasting Co., London, England.

Directors-at-large, 1952-1954—John D. Ryder of the University of Illinois, Urbana, Ill.; and Ernst Weber of Polytechnic Institute of Brooklyn, Brooklyn, N. Y.

Regional directors, 1952-1953: Region 1—Glenn H. Browning of Browning Lab. Inc., Winchester, Mass.; Region 3—Irving Wolff of RCA Laboratories Div., Princeton, N. J.; Region 5—Alois W. Graf of Chicago, Ill.; Region 7—Karl Spangenberg of Stanford University, Stanford, Calif.

The following IRE awards were also made at the board meeting:

Morris Liebmann Memorial Prize, 1952—William Shockley of Bell Telephone Laboratories, Murray Hill, N. J.

Browder J. Thompson Memorial Prize, 1952—H. W. Welch, Jr. of University of Michigan, Ann Arbor, Mich.

Vladimir K. Zworykin Television Prize Award, 1952—B. D. Loughlin of Hazeltine Electronics Corp., Little Neck, N. Y.

Editor's Award 1952—Jerome Freedman of Watson Lab., Griffiss A.F.B., Rome, N. Y.

NOL's New Cold Roll Mill

THE NEW Sendzimir cold roll mill, which produces extra-thin tapes used in pulse transformers, magnetic amplifiers, radar equipment and other high-frequency operations, is now in use at the Naval Ordnance Laboratory, White Oak, Md.

The mill, capable of rolling metals to a thinness of a few tenths of a thousandth of an inch, was built at a cost of $75,000. It was installed in the spring of 1951. Work on control

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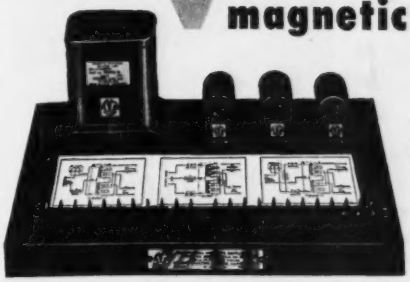

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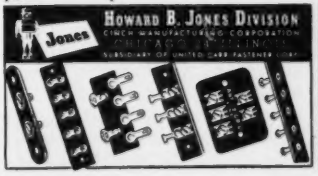

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adjustments and electrical circuits continued through the summer under the direction of engineers from Armzen Co., designers and engineers for Tadensz Sendzimir, inventor of the mill, and GE engineers who built complicated electrical controls.

The first test run gave a thinness of 0.0005 in. with magnetic alloys which were rolled from 0.05 beginning thickness. Chief advantage of the new mill, in addition to the very fine gage achieved, is the fact that it will handle wider strips of magnetic alloys than will the mill previously used.

There are only four other such mills in operation in the U. S. at present. They are located at Westinghouse, General Electric, The Hamilton Watch Co. and North American Phillips.

Government Appointments

LONG experienced in the electronics field, George W. Henyan of Schenectady, manager of General Electric Industrial and Transmitting Tube operations for the past three years, has accepted a temporary appointment as chief of the components branch of the National Production Authority's Electronics Division. A veteran of 33 years with General Electric, he will make his headquarters in Washington.

Another recent appointment is that of Leslie E. Neville, at one time editor of McGraw-Hill's *Aviation* Magazine, to director of the Department of Defense's newly organized Armed Services Technical Information Agency. ASTIA will be responsible for collecting, cataloging and storing scientific and technical information from all available sources. It will also provide a scientific and technical bibliographic service to military agencies and their contractors.

Franklin Lamb, vice-chairman of the board of Tele King Corp., New York, and a member of the Electronics Board of National Production Authority, has been appointed assistant to the Director of Defense Mobilization.

Robert McCurdy, associated with the National Production Authority since March 1951, has been ap-

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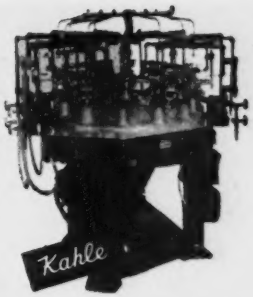

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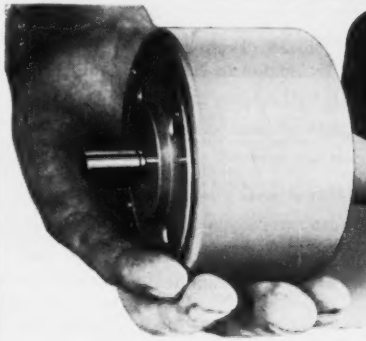

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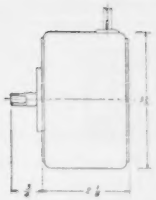
MODEL N2B

EAD



Originally designed and manufactured to operate into EAD synchronous motors in precision test equipment. Will meet all military specifications—high and low ambient temperature, humidity, altitude, dust, tropicalization, vibration and corrosion.

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Output 7 volts and 30 cycles, at 1800 RPM. Extremely low harmonic distortion, continuous duty, ball bearings.

This alternator may be modified to meet your individual requirements in 1, 2 or 3 phase for wide voltage ranges at required frequencies.

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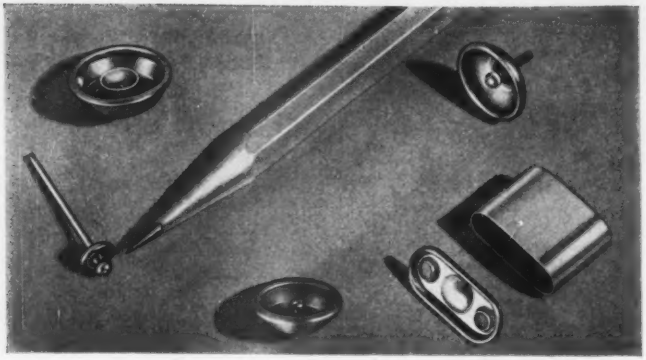

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pointed deputy director of the Scientific and Technical Equipment Division of NPA.

Norman L. Winter, chief sales engineer for Sperry Gyroscope Co., Great Neck, N. Y., has been appointed chairman of the Navigation Technical Group of the Research and Development Board, Department of Defense.

Lauriston S. Taylor has been promoted from assistant chief to chief of the Atomic and Radiation Physics Division of the National Bureau of Standards, and Coordinator of Atomic Energy Commission Projects at NBS.

WMIT (F-M) Reopens

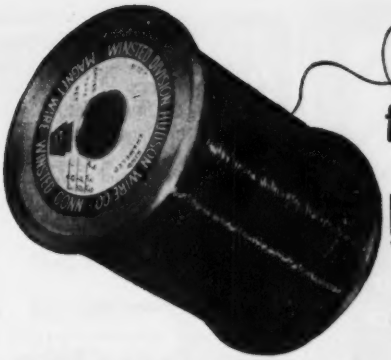
THE HIGHEST radio station in the eastern United States is again on the air 18 hours a day. WMIT, located on Clingman's Dome, Mount Mitchell, N. C., is the world's most powerful f-m station by virtue of its effective radiated power of 300 kw.

The pioneer station, off the air since early 1950, has new owners, a new 8-bay doughnut antenna array, and a new 50-kw Symmetron-type final amplifier (described on p 68, May 1949 ELECTRONICS).

New REA power lines and transformers, already installed, will allow the station to increase its erp to 325 kw, not feasible while using diesel power plants at the transmitter.

The top of the antenna pole is 6,773 feet above mean sea level, but because of the generally high level of the surrounding terrain within a radius of ten miles, its height is figured as 3,076 feet by FCC. A 100-foot fabricated tower is surmounted by the 80-foot pole carrying the doughnut elements and their deicers. These are of a new type tuned with stubs rather than capacitors and are adjusted for optimum operation in fog. Clear-weather or icing conditions throw them out of resonance but with a negligible standing-wave ratio.

Preliminary surveys of reception show that signals are far above predicted values. At High Point, N. C., on the 50-microvolt contour, the actual signal is in the order of 1,200 microvolts. A station in Myrtle



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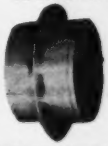

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The short time breakdown voltage of a well-made D.C. capacitor is not less than 5 to 6 times the actual working voltage at 20°—

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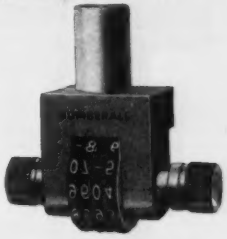
NUMBERING MACHINES with TWO WHEELS • QUICK Change Feature • Model No. 85

for stamping into Metal, Wood, Fiber and other Material.

Can be furnished with any number of wheels up to 20. Two wheels—The unit wheel and the tens wheel can be turned by using the two outside knobs to quickly set the required number. This greatly facilitates consecutive numbering. Model 86 has all wheels, quick change. Bulletin E85.



NEW MODEL 70

Multi-Wheel Numbering Machine

MACHINE AND SHANK ALL ONE PIECE

Model 70

The most efficient method of stamping numbers into metal. Repeats the same numbers until changed. Model 70 NUMBERALL Machines are used in all industries to mark various parts. Stamps numbers, etc., quickly . . . neatly. Perfectly aligned. Much better marks are reproduced by these machines than by single stamps or steel type, and at a far lower cost. Shank for Hand or Press and with any number of wheels from 3 to 20. Bulletin E-70.

IMPROVED TYPE HOLDERS

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Hand or Press style. Type can be easily, quickly loaded and unloaded. Simplest construction . . . Just a sturdy pin holds the type securely. No screws nor springs. Super-quality steel type made in various sizes: 1/32" up to ½" figures and letters.

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NEW! TYPE RXZ COMPARATOR

MAKES HIGH SPEED CIRCUIT COMPARISON OF COMPONENTS EITHER RESISTIVE, REACTIVE OR IN COMPLEX ELECTRONIC CHASSIS, ASSEMBLIES, SUB-ASSEMBLIES AND/OR COMBINATION — CHECKS AGAINST STANDARD CHASSIS

Reduces Inspection Time Up to 75%
—Semi-Skilled Personnel Can Operate

This instrument is used to compare a fully assembled chassis, no matter how complex the circuitry, against an identical chassis that has been found satisfactory by the usual testing methods and thus is standard. The deviation, in percent, of the circuit under test as compared to the standard circuit is indicated on a calibrated dial.

In the hands of semi-skilled personnel, the RXZ Comparator becomes a valuable instrument for fast trouble-shooting as well as test and inspection — reduces inspection time to one-fourth of your present time.

PINPOINTS CIRCUIT TROUBLE

A switching system is incorporated in the RXZ Comparator by which abnormal deviations are pinpointed in the chassis under test. Besides means for sequential checking of a multiplicity of directly compared circuits in rapid order, means is incorporated for specific trouble-shooting by point-to-point impedance measurement. A wide range ohmmeter is included for individual component analysis.

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Beach, S. C., about 250 miles away, is programmed exclusively by signals from WMIT since the quality is superior to that obtained from existing telephone lines in the region.

Programs broadcast from WMIT are received by microwave link from the studios in Charlotte, N. C.

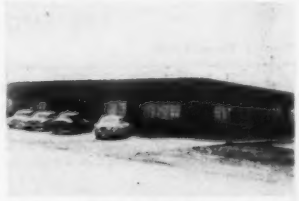
Expansion for Military Production

THE General Electric Company's Electronics Division at Electronics Park recently announced that it will use two buildings and part of a third at Bridgeport, Conn., for the design and manufacture of military electronic equipment. Floor area to be devoted to the new production will total 150,000 sq ft. Employment at the three locations is expected to reach 1,000 people by next fall. Several types of electronic equipment, including radar, will be manufactured in Bridgeport for the armed services.

Other expansions recently noted are as follows:

The Electronic Engineering Co. of California has moved to a new building at 176 South Alvarado St., Los Angeles. The new structure provides three times the size of former quarters. The company, active in the field of guided missile instrumentation, owes much of its growth to the awarding of additional armed services contracts.

Computer Research Corp., manufacturer of a ferroresonant flip-flop that has wide application in the guided missile and telemetering fields, has moved to 3348 W. El Segundo Blvd., Hawthorne, Calif., increasing available plant space approximately eight times.



Computer Research Corp.'s new building

Bendix Aviation Corp. has purchased the Utica, N. Y., plant of the Continental Can Co., Inc., to facili-

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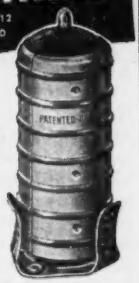

The shield that fits all Miniature Tubes

A flexible shield that snugly fits all miniature tubes because it compensates for all variations in tube dimensions. Mini-Shields are made for both T5 ½ and T6 ½ bulb tubes. Send for catalog sheet.

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	A.1.	74	1.7	0.11	0.36	
	A 2	74	1.3	0.24	0.44	
HIGH POWER FLEXIBLE	A 34	73	0.6	1.5	0.88	
	LOW CAPAC. Types	CAPAC. mmf/ft.	IMPED. Ohms.	ATTEN. db/100ft. 100 Mc/s.	OD"	
	C 1	7.3	150	2.5	0.36	
PHOTOCELL CABLE	PC 1	10.2	132	3.1	0.36	
	C 11	6.3	173	3.2	0.36	
	C 2	6.3	171	2.15	0.44	
	C 22	5.5	184	2.8	0.44	
	C 3	5.4	197	1.9	0.64	
VERY LOW CAPACITANCE	C 33	4.8	220	2.4	0.64	
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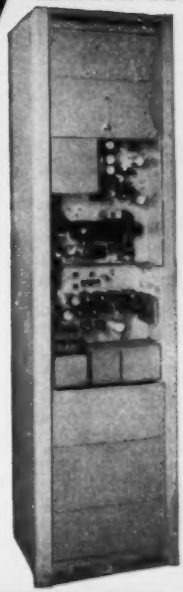

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Model PT-102

Used in transmitting stations, laboratories and in receiver factories where a reliable standard video signal in the form of a test pattern is a prime requisite for testing overall video performance.

- Composite Video Signal.
- Wide Band Video Amplifier, 3 db down at 7 mc.
- Dual outputs for feeding two 75 or 100 ohm lines.
- Black positive or Black negative output.
- Resolution greater than 500 lines.

INPUT: Vertical and Horizontal Driving Pulses, Camera and Kinescope Blanking Pulses.

OUTPUT: Composite Video Signal, 2 Volts peak to peak. Complete with tubes, high and low voltage power units, cabinet rack.

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CONSTANT RESISTANCE
HIGH POWER RATING

TERMALINE

COAXIAL LOAD RESISTORS

51.5 ohms DC to 4000 mc—5 watts to 2500 watts

The constant resistance (Low VSWR) of the TERMALINE resistor make it the ideal dummy load and standard resistor at UHF and VHF. Design is such that normal reactance is put to work producing a pure resistance over an extremely wide frequency range. Acting as a "bottomless pit" for RF energy, thousands of TERMALINE units are in daily use with high frequency transmitters.

Size 3⅛" x ¾" dia.
Very handy in lab and production test. At signal generator levels and below 5 watts, this is the last word for low VSWR.

SIX MODELS AVAILABLE

Model	Cont. Power Rating	Input Connector
80-SF	5 watts	UG-23B/U
80-SM	5 watts	UG-21B/U
80A	20 watts	UG-23B/U
81	50 watts	UG-23B/U
81B	80 watts	UG-23B/U
82	500 watts	Adaptor to fit UG-21B/U supplied.
82C	2500 watts	

Other adaptors or cable assemblies for any standard coaxial line available.

All TERMALINE units, except Model 82C, are self-cooled and require no auxiliary power. Substantial quantity discounts.

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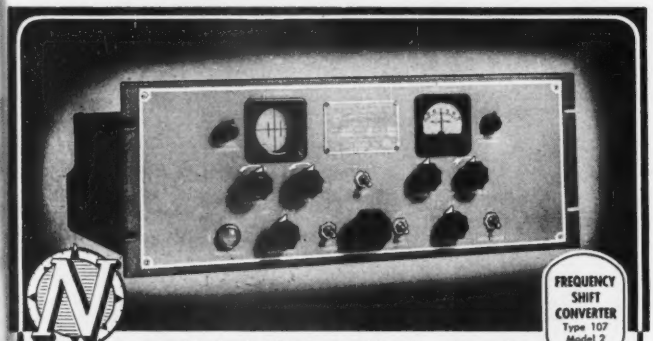

FREQUENCY SHIFT CONVERTER
Type 107
Model 2

BIGGEST PERFORMANCE—Smallest Size

Four *exclusives* are yours with the Northern Radio FREQUENCY SHIFT CONVERTER —utmost simplicity of operation, precision tuning, highest quality performance, and smallest size in the industry.

For single and diversity FS receiving systems, this dual channel unit converts mark and space tones into DC pulses, and drives teleprinters and other recorders directly. Its unique 2" oscilloscope provides the industry's most meaningful tuning pattern for precise receiver adjustment—during initial setup and while keying. Its specially designed limiter and discriminator afford an exceptionally high degree of performance. Polar or neutral output is available. Keying speeds up to 600 w.p.m. It's only 19" wide x 7" high x 15" deep.

This unit may also be used as a make and break CW or ICW demodulator.

See the specifications on this outstanding model in the 1951 Electronics Buyers Guide. For complete data on the precision-built Northern Radio line, write today for your free latest Catalog E-1.

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Pace-Setters in Quality Communication Equipment

tate expanded production of precision equipment required by the military services.

Electronic Positions Available

HOLLOMAN Air Force Base, near Alamagordo, New Mexico, has openings for positions in electronic engineering and physics. Openings also include numerous positions as electronic scientists, physicists, mathematicians, electronic laboratory technicians, radar technicians, telemetering technicians and others.

Applicants with education and experience in these fields are urged to submit Application for Federal Employment, Standard Form 57, to the Civilian Personnel Office, Holloman AFB, New Mexico. This application form can be obtained from most first or second-class postoffices or from U. S. Civil Service Commission.

BUSINESS NEWS

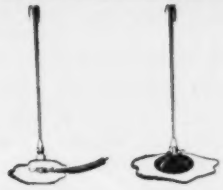
MAGNECORD, INC., Chicago, Ill., manufacturers of high-fidelity professional tape recorders, have formed a new corporation, Magnecord International Ltd., to handle all the company's business outside of the Western Hemisphere.

VARIAN ASSOCIATES of San Carlos, Calif., developers and manufacturers of electronic products, have leased approximately ten acres of Stanford University land. Construction of a 30,000-sq ft million-dollar research and development laboratory is expected to start early in 1952 and be completed within one year.

ASTRON CORP., East Newark, N. J., has consummated a long-term lease for additional space which virtually doubles production facilities for its capacitors and r-f interference filters.

LINDBERG INSTRUMENT CO., Berkeley, Calif., has moved to larger headquarters in that city to begin full mass production of Fluid Sound, a new phonograph pickup cartridge that applies the princi-

Civil Defense
RADIO ANTENNA



Mobile operations in 1¼, 2 and 6 meters are working surprisingly well with low mobile power — particularly with Premax low-cost VHF Antennas. Illustrated are two roof-top jobs, the one at left requiring a single ½" hole for one-man installation. The one at the right utilizes suction cup mounting requiring no holes and yet is always available for service.

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NEY #90 Alloy, overcomes many of the disadvantages of coin silver when used in slip ring and commutator bar applications. Actually a modification of coin silver, NEY #90 is subjected to a carefully controlled processing that produces a uniform hardness of 120-130 Brinell which has been found best for slip ring type applications. Since performance is also markedly influenced by surface condition, especially when brush pressure must be low, NEY #90 Alloy rings are given a specially developed finish that greatly reduces wear and electrical noise. NEY #90 Alloy is available in seamless tubing in all sizes up to 4" O. D., also in the form of plate, rod, wire and fabricated parts.

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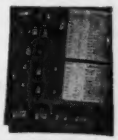

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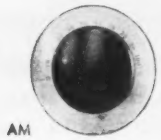
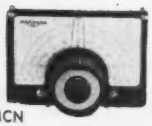

AM

N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MEGACYCLE FREQUENCY-TIME COUNTER

Model 801
by Potter

Now, the Potter Instrument Company offers all in one equipment, the features heretofore available only in separate counting systems. Two complete counting channels, a 100 kc crystal oscillator time base and unique gating circuits are combined to provide the new FREQUENCY-TIME COUNTER.

FREQUENCY MEASUREMENTS	0 to 1 mc range by counting cycles per pre-selected time or by measuring time per pre-selected count. Accuracy 0.001% minimum.
TIME INTERVAL MEASUREMENTS	0 to 10 seconds ± 10 microseconds.
FREQUENCY RATIO MEASUREMENTS	Ratio of two external frequencies can be measured.
SECONDARY FREQUENCY	100 kc crystal oscillator with divided frequencies available at 10, 1 kc and 100, 10, 1 cps.
TOTALIZING COUNTER	Six decades, pulses 0 to 1 mc, sine wave 10 cps to 1 mc.
DIRECT RPM READING TACHOMETER	Through the use of an external 60 count per revolution photoelectric disc generator an accuracy of ± 1 rpm is obtained.

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ples of fluid-damping and fluid-coupling to sound reproduction.

STACKPOLE CARBON CO., St. Marys, Pa., has opened a new 45,000-sq-ft branch plant in Kane, Pa., for the manufacture of electronic components.

RADIO RECEPTOR CO., INC., Brooklyn, N. Y., manufacturer of radio and electronic equipment for government and industry, is increasing its plant capacity to manufacture germanium diodes.

UNION PLASTICS CORP., New York City, recently opened a new plant at Secaucus, N. J., that includes the newest development in machinery for the extrusion of Polychlorotrifluoroethylene.

AMPEX ELECTRIC CORP., manufacturer of magnetic tape recorders, has moved to a new plant in Redwood City, Calif. The new factory will include special departments for telemetering and instrumentation development.

GENERAL RADIO CO., manufacturer of electronic, radio and electrical laboratory apparatus, has begun construction of a new 72,000-sq-ft plant in Concord, Mass. All of its Cambridge facilities are still being maintained.

PERSONNEL

ROBERT DRESSLER, for the past five years in charge of various aspects of tv research for Paramount Pictures Corp., has been appointed director of research and development for Chromatic Television Laboratories, Inc., New York City.

STANLEY F. PATTEN, until recently director of mobilization planning for the Government Department of Allen B. Du Mont Laboratories, Inc., has been elected vice-president of the corporation.

L. R. LUDWIG, with Westinghouse Electric Corp. since 1925, was recently appointed director of engineering and research for the company's atomic power division in Pittsburgh, Pa.

HARRISON JOHNSTON, formerly with General Electric Co., has been

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appointed manager of the newly created product engineering division of Ampex Electric Corp. His headquarters will be at the company's Redwood City, Calif., factory.

HENRY F. ARGENTO has been elected an assistant vice-president of Raytheon Mfg. Co., Waltham, Mass., and named assistant manager of the company's power tube division. He had served since 1941 as sales manager of the division.

EDWARD J. DUCKETT was recently appointed to the expanding development laboratories of Fisher Scientific Co., Pittsburgh, Pa. He will be in charge of the work of the electronics laboratory in the development of new laboratory instruments, apparatus and techniques.

JAMES B. FERGUSON, with Link Radio Corp., New York, N. Y., as consulting engineer since June 1950, has been appointed chief engineer of the organization.

J. B. Ferguson

A. W. Friend

ALBERT W. FRIEND, formerly a member of the research staff of RCA Laboratories at Princeton, N. J., was recently appointed director of engineering for the Daystrom Instrument Division of Daystrom, Inc., Elizabeth, N. J.

WILLIAM A. EDSON has been promoted from professor of electrical engineering to director of the school of electrical engineering at Georgia Institute of Technology, Atlanta, Ga.

SOL LEVINE, associated with Edo Corp., College Point, N. Y., for the past five years, was recently appointed chief engineer of the company's electronics division.

E. G. SHOWER, formerly a member of the technical staff of Bell Tele-

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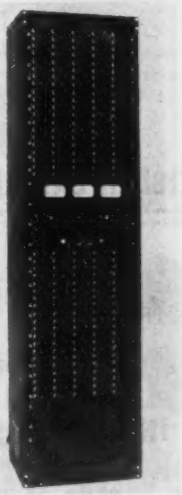

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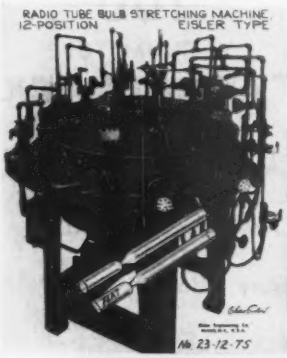

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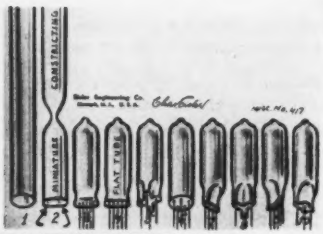

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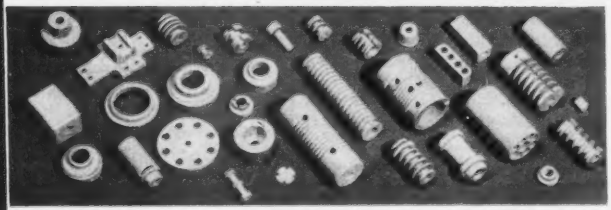

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phone Laboratories, has joined the staff of Radio Receptor Co., Inc., Brooklyn, N. Y., as chief engineer of its newly formed germanium division.

CARL F. MILLER, inventor of the Loktal radio receiving tube that locks in its socket, has been named manager of Westinghouse receiving tube development and design engineering.

MURRAY WEINSTEIN, former consulting engineer in the electronics industry, is now associated with Regal Electronics Corp., New York, N. Y.

PALMER M. CRAIG has been promoted from director of engineering in the electronics division of the engineering department to vice-president—engineering for the television and radio division of Philco Corp., Philadelphia, Pa.

HAROLD R. TERHUNE, formerly vice-president of the Mycalex Tube Socket Corp., Clifton, N. J., was recently appointed administrative engineer at Federal Telecommunication Laboratories, Inc., Nutley, N. J.

H. R. Terhune

W. R. MacGregor

WALLACE R. MACGREGOR, formerly on the FCC staff as common-carrier engineer, has joined Lenkurt Electric Sales Co. as manager of government sales for carrier telephone and telegraph systems.

W. L. PARKINSON of General Electric Co. has been named chairman of the RTMA Service Committee.

W. A. LAUDER, chief engineer of Unimax Switch Division of The W. L. Maxson Corp., New York, N. Y., has been elected chairman of the Precision Snap-Acting Switch Section of the National Electrical Manufacturers Association.

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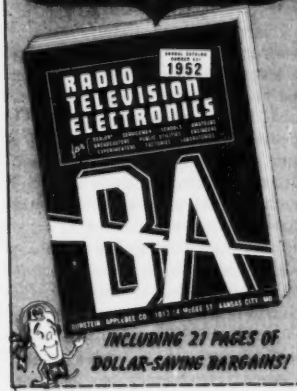

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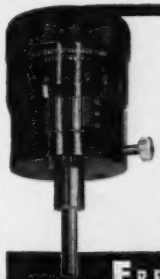

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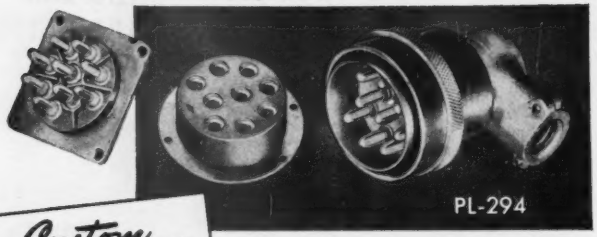

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NEW BOOKS

(Continued from page 152)

the exception of saw-tooth generators and some notes on the cathode-ray tube there is little directly applicable to modern television deflection systems.

This is an ambitious attempt to incorporate in one volume a complete reference on time bases and their applications. As a result, one may not find adequate coverage on his particular problem. He will, however, find a wealth of background material and ample references.

Because of the ever-increasing use of time bases this book is almost certain to find an even greater acceptance than the widely used first edition.

R. F. CASEY,
Development Engineering Section, Instrument Division, Allen B. Du Mont Laboratories, Inc.

Television Principles

BY ROBERT B. DOME. *McGraw-Hill Book Company, New York,* 1951, 291 *pages,* $5.50.

An easily followed introductory text, on the engineering level, to the problems of television transmission and reception. As each of the successive portions of the complete television system is taken up, a discussion of the relevant theoretical principles is given. This discussion is followed immediately by the practical considerations encountered in the application of the principles and by problems for the student to solve. The range of the topics treated is broad enough to insure that any engineer who has gone through the text carefully will have had an effective introduction to the problems of the television art.

From the point of view of its use as a reference book, a sort of handbook of television engineering, the book is less satisfactory. The very plan of organization which is successful in making the book a readily followed introductory textbook requires the presence of large amounts of expository material. It also tends to distribute through the body of the book information which should preferably be kept together if the book were primarily intended for reference purposes. For example, the FCC Standards of Good

Engineering Practice are distributed in a number of places throughout the book rather than being in a single place for convenient reference.

A. V. LOUGHREN,
Director of Research, Hazeltine Corp.

The Earth's Magnetism

BY SYDNEY CHAPMAN. *Methuen's Monographs on Physical Subjects, John Wiley & Sons, Inc., New York, 1951, 127 pages, $1.50.*

THIS pocket-size monograph is a revision of the one published in June 1936, and contains "a brief but fairly broad account of our present knowledge of the earth's magnetic field and its changes." Written by one of the foremost authorities, this book can be recommended as an excellent summary of an introduction to the subject, which the reader can supplement, if he so desires, by reference to the published works mentioned on page 117 of the monograph.

The book is largely descriptive, but also includes some theoretical material on the nature and causes of the earth's magnetic field and its variations. The book covers the main magnetic field of the earth and its variations—annual, secular and sunspot-cycle variations, solar quiet-day variations, lunar daily variations, and variations during magnetic storms—together with the relationships between magnetic disturbances and solar phenomena.

The new material which has been added since the first edition includes notes on the initiation of a magnetic storm and the ring current, the association of magnetic effects and sudden ionospheric disturbances, the recurrence tendency of weak and moderate storms, the association of great storms with solar outbursts, correlation with cosmic rays and ionospheric phenomena, the magnetic field anomalies at Huancayo, and an idealized picture of the portion of the disturbance field due to external causes. A number of sections have been rewritten to bring them into agreement with current theories, such as the theory of the origin of the solar quiet-day variations.

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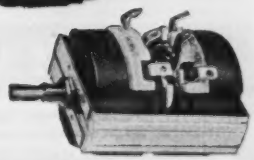

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241	50	2 -	75,000	300°	270°	Top	2⅜"	1½"	7 oz.
245	25	2 -	50,000	300°	270°	Top	1¾"	1¼"	4 oz.

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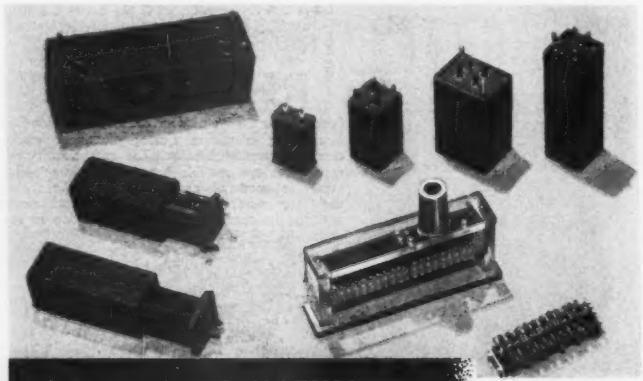

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touched only briefly, and only passing reference made to the aurora, earth currents, or the importance of radio research in the study of the earth's magnetism. The book is well and clearly written and can well serve as an introduction to the subject for the layman as well as a pocket reference book for the more experienced person.—NEWBERN SMITH, *Chief, Central Radio Propagation Laboratory, National Bureau of Standards.*

The High Pressure Mercury Vapor Discharge

BY W. ELENBAAS. *North-Holland Publishing Company, Amsterdam; Interscience Publishers Inc., New York,* 1951, 173 *pages,* $4.00.

THIS book from the pen of one of the outstanding workers in the field of high-pressure vapor discharges, W. Elenbaas of the Philips Laboratories, Eindhoven, Holland, should be of great interest to scientists, engineers and others who are concerned with research and development or application of high-pressure lamps. Since the use of high-pressure vapor lamps for general illumination as well as for ultraviolet irradiation processes has been expanding very rapidly in the last several years, and promises to continue to do so in the foreseeable future, the appearance of this book is especially timely and welcome.

The author limits his book to high-pressure discharge phenomena in mercury vapor only. Most of the theory, however, applies to other high-pressure discharges as well. Temperature equilibrium in the arc has been assumed as a general principle. The excitation of atoms and electrons is then governed by Boltzmann's Law, i.e., the laws of thermodynamics, and the concentration of electrons and positive ions is then determined by the Saha equation. Based on these two equations the theoretical treatment yields results which are in general in excellent agreement with observation.

The book is divided into ten chapters. The first one deals with the history, definition and the mechanism of the high-pressure mercury vapor discharge. The second, third and fourth chapters dis-

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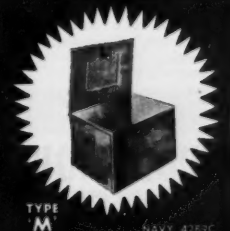

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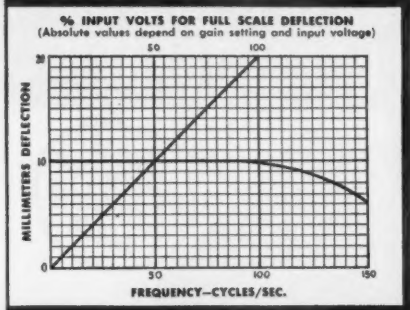

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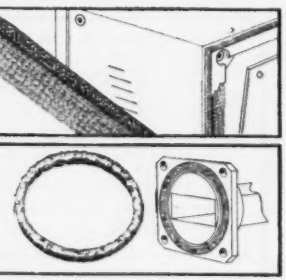

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cuss the elementary theory and the temperature of the discharge and its distribution within it. Chapter five is devoted to the interesting problem of convection in the high-pressure vapor discharge. Other factors affecting the discharge, such as longitudinal and transverse magnetic fields and the addition of rare gases and vapors of other metals, are treated in chapter six. Compact arc sources, which are becoming increasingly important, are briefly referred to in chapter seven. The spectrum of the radiation emitted by high-pressure lamps is treated quantitatively and qualitatively in chapter eight.

The remaining two chapters deal with miscellaneous subjects, as for example the electrodes, modulation and dimensioning of lamps and a discussion of the equilibrium state.

Extensive use is made of mathematics to explain the physical phenomena and interpret measurements of radiation characteristics and other observations associated with high-pressure discharges. To the reader who is sufficiently equipped to follow the mathematical treatment, the results obtained are most illuminating and satisfying. To the average engineer who may be insufficiently trained in mathematics, some of the most interesting and important chapters could perhaps be made better accessible by placing more emphasis on the physical phenomena and the fundamental processes underlying them. This is by no means meant as a criticism of this excellent book, but rather as a suggestion for consideration in future editions.

J. H. LAUB,
Vice-President,
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Electronics

BY JACOB MILLMAN AND SAMUEL SEELY. *McGraw-Hill Book Co., Inc., New York*, 1951, *second edition*, 598 *pages*, $7.25.

IN GENERAL, the content and philosophy of the first edition have been retained in this second edition. The approach is fundamentally theoretical, and the information presented provides a thorough foundation for specialized work in any branch of electronics.

It should be emphasized that the

book is primarily intended to furnish theory, and not practical fundamentals. Little is presented that would benefit the practicing circuit designer directly. Studied alone, the book would leave the reader knowing much about electron phenomena, but his ability to apply his knowledge in the practical sense would be limited.

As a text for a basic college level course in the physical concepts of electronics (for which the book is intended), "Electronics" is as good, or probably a bit better, than most. After being used as a text for such a course, it fits into an engineer's library as a reference source.

The two chapters on audio amplifiers in the first edition have been omitted from the second. This is not too great a sacrifice, since audio amplifiers are well treated in the books that normally would be purchased subsequently for more advanced and specialized study.

—J. D. F.

Fundamentals of Atomic Physics

BY SAUL DUSHMAN. *McGraw-Hill Book Company, New York, 1951, 294 pages, $5.50.*

THE MATERIAL of this volume was originally intended as an aid to a group of high school teachers of science in enlarging their "grasp of new developments in the physical sciences". Inasmuch as somewhat more than one third of the book is devoted to nuclear physics, including a 43-page chapter on particle accelerators, it would seem that "A Brief Survey of Modern Physics" might be a more fit title than the one used.

Many subjects are treated in this small volume, most of them necessarily with extreme brevity. Examples are the first chapter, correctly entitled "A Brief History of Physics", in which little more than a listing of scientists and their accomplishments can be given, and the second, "Mathematical Introduction", in which algebraic and trigonometric functions, differential and integral calculus, as well as partial differential equations, are discussed in 22 pages. It seems un-

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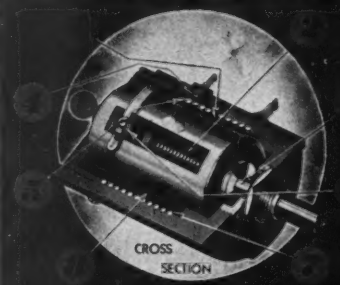

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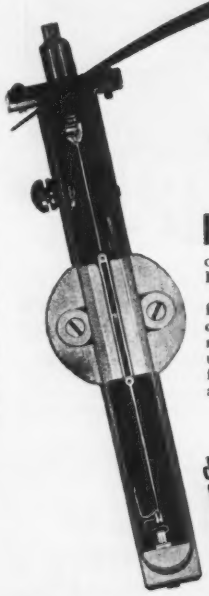

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likely that teachers of science would profit by the cursory treatment of these subjects.

After the introductory material, two chapters are devoted to kinetic theory. An impressive number of equations is given, although they are usually made plausible, rather than derived. It is obvious that the author understands the subject in great detail but the impression is created that he must hurry along to complete his task in the allotted time. Chapter 5 through 11 cover the standard material of atomic physics—properties of the electron, photoelectric effect, x-rays, optical spectra and electron diffraction. Many quantitative relations are again given with brief derivation but with clear understanding and accuracy. The coverage is very wide and probably quite useful, as a review, to one who has already studied undergraduate courses in optics, mechanics, and electricity, but certainly too superficial for a student exposed to the material for the first time. The last part of the book, chapters 12 through 14, is devoted to nuclear physics, and gives an accurate review of this field, especially of the "big machines", including those not yet in operation. Excellent diagrams illustrating the operation of those accelerators, as well as simple explanations of the principles involved, are given in each case.

In covering the wide range of topics, the author often resorts to direct quotations, apparently in an effort to gain authenticity. These quotations add nothing to the value of the book and certainly are distracting in their frequency. As an example, the chapter on accelerators, consisting of 43 pages, contains 25 quotations, ranging from a sentence to over a page. In a different connection (p 227) a sentence from another author's condensation of the Smyth report is used. Judging from those sections containing no quotations, one is convinced that the author's own words are quite effective, and that he could do very well with them alone.

This book is certainly not a substitute for those texts in specific fields that it quotes, and would not

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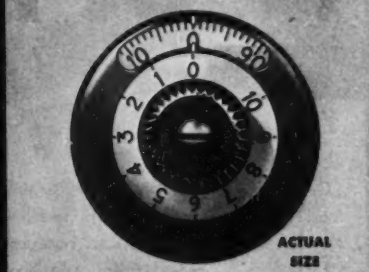

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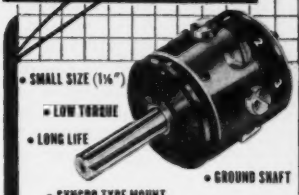

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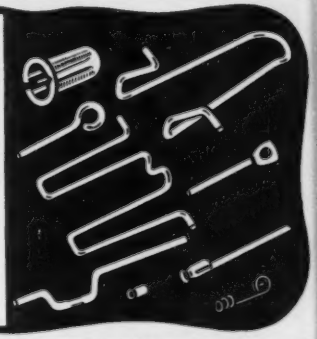

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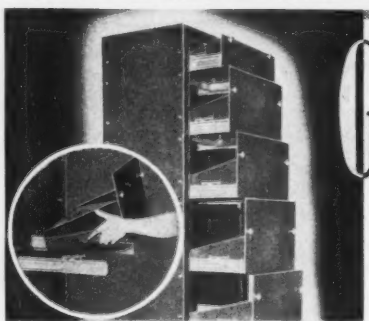

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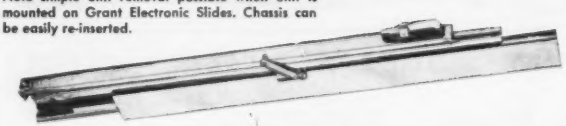

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be useful for a student majoring in physics. However, it will serve very well as a review of modern developments for those already in possession of a general knowledge of physics, such as teachers of science or engineers.—D. J. HUGHES, *Brookhaven National Laboratory, Upton, Long Island, New York.*

THUMBNAIL REVIEWS

THEORY AND DESIGN OF VALVE OSCILLATORS. Second Edition. By H. A. Thomas. Chapman & Hall Ltd., 37 Essex St. W.C.2, London, 1951, 317 pages, 36s. Expansion of 1939 edition with five new chapters on uhf oscillators, velocity-modulated oscillators, magnetron oscillators, R-C oscillators and crystal oscillators.

THE PREPARATION OF PROGRAMS FOR AN ELECTRONIC DIGITAL COMPUTER. By Maurice V. Wilkes, David J. Wheeler and Stanley Gill. Addison-Wesley Press, Inc., Cambridge, Mass., 1951, 169 pages, $5.00. Procedure for building up a library of subroutines for carrying out standard mathematical processes on a machine such as the EDSAC, to make use of the machine feasible for problems requiring only a few hours of computing time. Covers types of machines, order codes, binary-decimal conversions, checking facilities, types of subroutines, proofreading of programs, tape punching, examples and specifications.

COLOR TELEVISION. By Edward M. Noll. Paul H. Wendel Pub. Co., Indianapolis, Ind., 1951, 45 pages, $1.00. Paper-cover booklet giving fundamentals of various proposed systems; intended as practical reference for experimenters and television servicemen.

HERBERT H. DOW. By Murray Campbell and Harrison Hatton. Appleton-Century-Crofts, Inc., New York, 1951, 168 pages, $3.50. An account of one man's share in the founding and building of The Dow Chemical Company.

ANALYSIS AND DESIGN OF TRANSLATOR CHAINS. By H. Zieboiz. Askania Regulator Co., Chicago, Ill., Second Edition, 1951, two spiral-bound volumes (Vol. 1—285 pages text; Vol. 2—392 diagrams), $6.00 per set. Intended to establish a systematic approach to the classification of mechanical, hydraulic, electric and electronic devices and thereby permit development of a number of alternate possible solutions to measurement and control problems.

200 MILES UP. By J. Gordon Vaeth, U. S. Navy Special Devices Center, ONR. The Ronald Press Co., New York, 1951, 207 pages, $4.50. History of upper air research with rockets and balloons, principles of rocket flight, V-2 operations at White Sands, and declassified information on Aerobee and Viking high-altitude sounding rockets. Intended as nontechnical but accurate summary of recent research.

CLEAR WRITING FOR EASY READING. By Norman G. Shidle. McGraw-Hill Book Co., New York, 1951, 176 pages, $3.00. Emphasis is on clear and simple writing using short sentences and short words. Examples and specific instructions are largely slanted toward engineers and technical writers.

CIVIL DEFENSE IN MODERN WAR. By Augustin M. Prentiss, Brigadier General, U. S. Army (Retired). McGraw-Hill Book Co., New York, 1951, 429 pages, $6.00. Text dealing with methods of protecting civil population and industrial plants against atomic, bacterial and chemical warfare. Includes recommendations on communications for civil defense.

(continued from page 154)

all manufacturers of parts so that the Institute receives information as requested.

Suggestions as to the information and format which would be most useful for each category of miniature parts will be welcomed from interested potential users of this index. They may be sent either to Mr. William A. Mussen, Supervisor Electronics Laboratory, Southwest Research Institute, or to Mr. Wasyl Zaricki, Code 839, Bureau of Ships.

PAUL M. ERLANDSON
Southwest Research Institute
San Antonio, Texas

Audio Damping

DEAR SIRS:

AN ARTICLE entitled "Audio Amplifier Damping" by Robert M. Mitchell in the September 1951 ELECTRONICS (p 128) has provoked the thought that the term "damping factor" (D), conventionally defined by the author as the ratio of load impedance to generator impedance is an inept and somewhat misleading term. According to this definition, decreasing amplifier output resistance results in increasing damping factors with no limit applying. Since increasing the damping factor does not result in increasing the damping in the same proportion, erroneous conclusions as to the significance of damping factor might be made by people not having an understanding of the technical factors involved. For example, if in two amplifiers of otherwise equal specifications, one had a damping factor of 20 and the other a damping factor of 30, it is not apparent to the uninitiated that the difference in damping would be insignificant.

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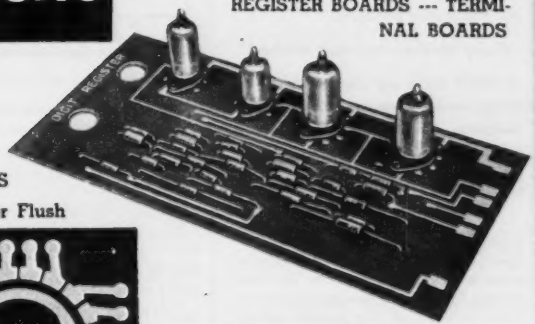

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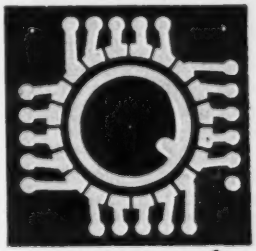

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pentodes) with uncomplicated and stable circuit arrangements. This practice is so general as to be incontrovertible.

The point of interest now rises as to how far this increase of damping factor should go without becoming absurd. It is our contention that increasing the damping factor beyond the order of 10 (for sake of the damping factor alone*) is not warranted from an engineering standpoint. This can most clearly be shown by redefining damping factor in such a way as to make more apparent its practical significance.

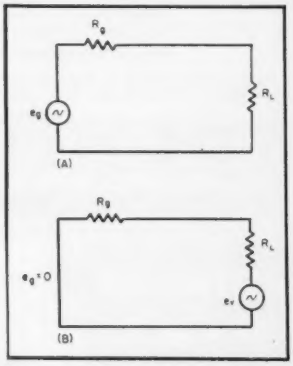

FIG. 1—Equivalent circuits showing audio amplifier damping

For this purpose it seems as though an electrical-damping figure of merit ø defined as

$$\phi = \frac{R_L + R_g}{R_L}$$

would provide a clearer understanding of the situation. This choice is not purely arbitrary but represents a figure as nearly in line with the actual principle of electrical speaker damping as possible. To see why this is so, let us review briefly the effect of the output impedance on the speaker.

Speaker damping is necessary because the moving parts of the reproducer (the voice coil) constitute the elements of a mechanically resonant system. This system is

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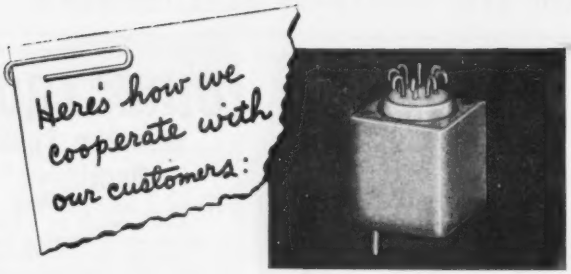

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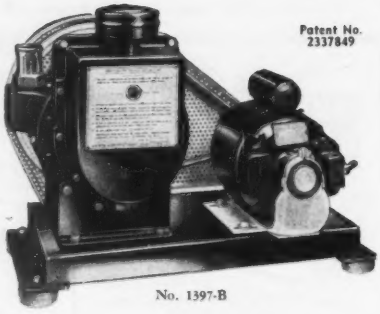

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damped acoustically by air, mechanically by friction, and electrically by the amplifier. When the speaker has been electrically excited by signals having frequency components in the vicinity of the mechanical resonance, the resulting vibration may persist after the electrical signal has ceased. This has been called "hangover effect". In the condition where the speaker cone is vibrating after the signal from the amplifier has ceased we may replace the conventional output circuit representation of Fig. 1A by Fig 1B in which the kinetic energy stored in the vibrating system causes a voltage to be generated in the voice coil (e_c).

Note that for both cases the electrical damping is provided by R_g in series with R_L. As R_g is reduced by feedback or other means, the total electrical damping resistance approaches R_L as an asymptote. Unless a means could be devised of making R_g negative, the damping resistance

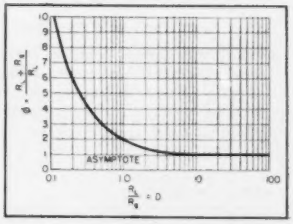

FIG. 2—Curve showing relationship between gain reduction factor and electrical damping figure of merit

can never become less than R_L. This is why reduction of the amplifier output impedance beyond the point where it is small compared to R_L (corresponding to a large damping factor) runs into the law of diminishing returns. It can be seen that the hereby proposed term of "electrical damping figure of merit" approaches unity as a limit as amplifier impedance decreases, where unity could be considered the normalized speaker impedance.

In Fig. 2, Mitchell's Fig. 5 has been translated to the one of gain reduction factor versus electrical damping factor of merit. Compar-

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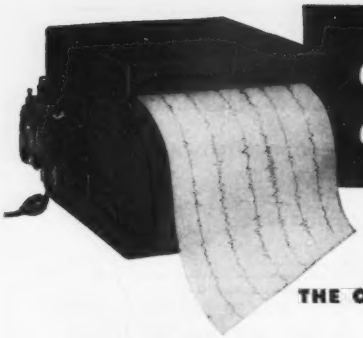

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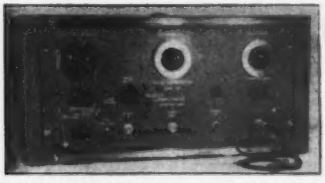

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ing the two curves it is seen that in Fig. 5 of Mitchell's article, the curve might well have been captioned "Note lack of superiority of triodes" instead of "Note superiority of triodes".

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Electronics Quiz

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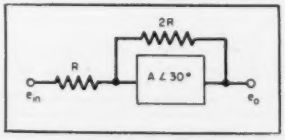

angle of thirty degrees leading. Introducing feedback $2R$ as shown, what is the maximum value of $|e_o|/|e_{in}|$?

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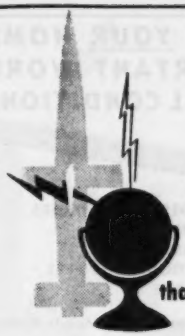

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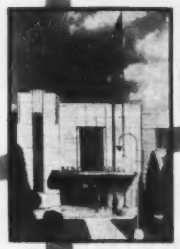

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Experienced in preparation & publication of standards, electronic & mechanical technical manuals. Engineering background necessary.

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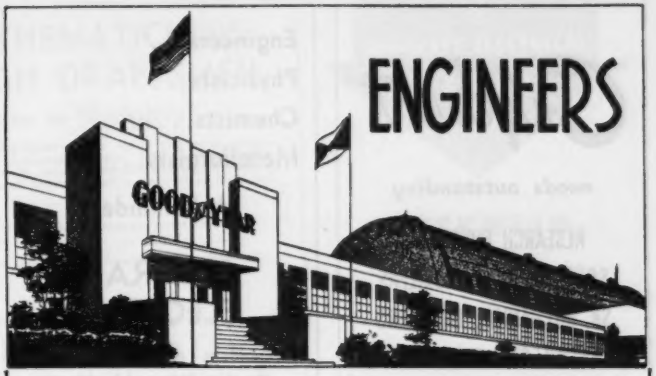

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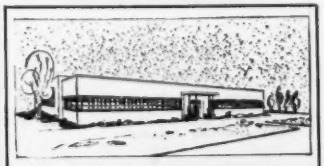

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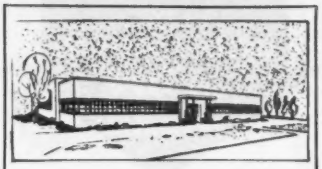

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DEPT. K-1

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4	600	1.65	1-1	2500	3.85
4	660R'd	1.65	32	2500	15.80
6	400	1.75	.5	3000	2.40
6	400	1.85	.03	4000	1.25
8	660R'd	1.85	3 x 2	4000	2.95
8-8	400	1.95	.1	5000	1.60
4-4-4	400	2.50	.2	5000	2.50
4 x 3	400	2.50	1	5000	4.58
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2	1000R'd	.95	1	7500	2.85
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HIGH VOLTAGE TRANSFORMERS

G.E.—Pri. 115V 60 cy. Sec. 6250V 80 MA—12.5 KV Ins.....$10.50
G.E.—Pri. 115V 60 cy. Sec. 6250/3850/2500V 80 MA 12.5 KV Ins.....$18.50
Raytheon—Pri. 115V 60 cy. Sec. 8500/6450V CT 43 MA Hermetically sealed.....$22.50

CRYSTAL DIODES

1N21	$1.19	1N23	$1.95	1N34	$ .79
1N21A	1.69	1N23A	2.25	1N34A	.95
1N21B	4.00	1N23B	5.25	1N45	.94
1N22	1.09	1N27	1.79	1N82	1.05

ANTENNAS

AT-38A/APT (70 to 400MC).....$13.70
AT-49/APR-4 (300 to 3300MC).....13.70
AN-74B (125 to 150MC).....3.25
AN-65A (P/O SCR-521).....1.50
AN-66A (P/O SCR-521).....1.75
AIA-3CM conical scan.....125.00
ASB Yagi—5 element 450 to 560MC.....7.00
ASB Yagi—Double stacked 5 element.....12.70
ASA Yagi—Double stacked 370 to 430MC.....29.40

WESTINGHOUSE HYPERSIL TRANSFORMER

PRI-115V. 60CY ⅝ KVA
SEC #1 - 240V - 1.56A
SEC #2 - 240V - 1.56A
WT. 30 LBS.

$14.50 EACH

GENERATORS

- Eclipse-Pioneer type 718-3A (Navy Model MEA-3A) Output—AC 115V 10.4A 800 to 1400cy. I.P. DC 30 Volts 60 Amps. Brand New.....$38.50
- Eclipse-Pioneer type 1235-1A. Output—30 Volts DC 15 Amps. Brand New—Original Packing..$18.50

Terms 20% cash with order, balance C. O. D. unless rated. All prices net F.O.B. our warehouse, Phila., Penna., subject to change without notice.

COAXIAL CONNECTORS

83-1AC	$ .42	83-1RTY	$ .45	83-22R	$ .48
83-1AP	.50	83-1SP	.50	83-22SP	1.15
83-1F	1.30	83-1SPN	.60	83-22T	1.95
83-1H	.10	83-1T	1.30	83-168	.15
83-1HP	.25	83-2AP	1.95	83-185	.15
83-1J	.90	83-22AP	1.40	83-765	.24
83-1R	.40	83-22F	2.10	83-776	.85
		83-22J	1.50		

FULL LINE OF JAN APPROVED COAXIAL CONNECTORS

IN STOCK

UHF—N—PULSE—BN—BNC

UG-7/AP	$6.30	UG-83/U	$1.85	UG-185/U	$1.60
UG-12/U	.95	UG-85/U	1.75	UG-191/AP	.90
UG-15/U	1.50	UG-86/U	2.50	MX-195/U	.75
UG-18/U	1.25	UG-87/U	1.60	UG-197/U	2.90
UG-19/U	1.80	UG-88/U	1.60	UG-201/U	1.95
UG-21/U	.95	UG-89/U	1.60	UG-203/U	.85
UG-21A/U	1.50	UG-90/U	1.60	UG-206/U	1.80
UG-21B/U	1.35	UG-98/U	1.85	UG-224/U	1.40
UG-22/U	1.35	UG-102/U	1.15	UG-236/U	2.85
UG-22B/U	1.65	UG-103/U	.85	UG-245/U	2.30
UG-23/U	1.20	UG-104/U	1.40	UG-254/U	2.75
UG-23B/U	1.90	UG-106/U	.15	UG-255/U	2.45
UG-24/U	1.30	UG-108/U	2.60	UG-260/U	1.60
UG-25/U	1.35	UG-109/U	2.60	UG-261/U	1.60
UG-27/U	1.30	UG-146/U	2.55	UG-262/U	1.60
UG-27A/U	2.95	CW-159/U	.60	UG-273/U	2.25
UG-29/U	1.55	UG-166/U	32.50	UG-274/U	2.75
UG-30/U	2.30	UG-167/U	5.85	UG-275/U	2.50
UG-34/U	16.50	UG-171/U	2.80	UG-276/U	2.75
UG-36/U	17.50	UG-172/U	.40	UG-290/U	1.60
UG-37/U	17.50	UG-175/U	.15	UG-291/U	1.75
UG-57/U	2.30	UG-176/U	.15	UG-306/U	2.95
UG-58/U	.80	UG-177/U	.24		

QUOTATIONS UPON REQUEST ON ANY CONNECTORS NOT LISTED HERE

M-358	MC-277	PL-259A	PL-325
M-350	MC-320	PL-274	SO-239
M-359A	PL-258	PL-284	SO-264
M-360	PL-259	PL-293	TM-201
93-C	49120	D-163950	E8-685696-5
93-M	49121A	D-166132	E8-689172-1

TYPE "J" POTENTIOMETERS

Resis.	Shaft	Resis.	Shaft	Resis.	Shaft
50	SS	5K	1/4"	50K	3/8"
60	9/16"	5K	3/8"	50K	1/2"
100	SS	5K	1/2"	100K	SS
200	SS	10K	SS	150K	1/2"
250	1/8"	10K	3/8"	200K	3/8"
500	SS	10K	1/2"	250K	SS
500	8/16"	15K	SS	250K	3/4"
500	1/2"	15K	1/2"	250K	3/8"
500	5/8"	20K	SS	500K	SS
650	1/2"	25K	SS	500K	1/4"
1K	SS	25K	1/4"	500K	7/16"
2K	3/8"	30K	1 1/8"	1 Meg	SS
2500	SS	40K	SS	2.5 Meg	SS
4K	SS	40K	1/4"	5 Meg	SS
5K	SS	50K	1/4"		

DUAL "JJ" POTENTIOMETERS

50	SS	500	SS	1 Meg SS
100	SS	1K	SS	2.5 Meg SS
250	SS	2500	SS	5 Meg SS
330	SS	10K	SS	1K/25K 3/8"

TRIPLE JJJ POTENTIOMETERS

100K/100K/100K—⅝" 20K/150K/15K—⅜"

SOUND POWERED TELEPHONES

U. S. NAVY TYPE M HEAD AND CHEST SETS
U.S.I. A-290 W.E. D-173013
A.E. GL832BAO
ANY TYPE—$14.50 EACH
TS-10 Type Handsets.....$8.92 ea.

F. W. BRIDGE SELENIUM RECTIFIERS

AC Volts Input	18	AC Volts Input	40
DC Volts Out	14.5	DC Volts Out	34
1.3 Amps	$3.85	0.6 Amps	$4.60
2.4 Amps	4.95	1.2	5.95
6.0 Amps	7.75	3.0	8.95
13.0	12.75	6.0	15.50
17.5	15.75	9.0	17.50
24	22.75	12	26.95
39	35.50	18	32.50
52	38.50	25	42.50
78	49.50	36	59.50

130 VAC ½ WAVE STACKS

75MA	$.88	150MA	$1.30	250MA	$1.75
100MA	1.10	200MA	1.57	400MA	2.40

3 PHASE INVERTERS

Voltage and Frequency Regulated
Eclipse Pioneer Type 12121A

DC Input—24 Volts 18 Amps
AC Output—115 Volts 1.25 Amps 3 Phase
250 VA 0.7 P.F. 400 Cycles
12,000 RPM 85°C Temp. Rise
Brand New.....$225.00

TEST EQUIPMENT

- I-222A Signal Generator.....* $79.50
- I-72K Signal Generator.....$48.50
- C-D Quistone Filter Type 17-10 110/220V AC/DC 20 Amps.....* $9.00
- TS-127/U Freq. Meter w/spares.....$89.50
- TS-143/CPN Oscilloscope.....* $95.00
- Dumont 175A Oscilloscope.....*$225.00
- LM-20 Frequency Meter.....* $49.50
- Gen. Radio 737-PI Power Supply.....* $27.00
- TS-6/AP Frequency Meter.....* $42.00
- I-130A Signal Generator.....* $85.00
- A.W. Barber Labs. VM-25 VTVM.....* $86.00
- TS-10A/APN Delay Line Test Set.....$45.00
- TS-19/APQ-5 Calibrator.....$79.00
- REL W-115B Frequency Meter 190-220 MC $32.95
- CW1-60AAG Range Calibrator for ASB, ASE, ASV and ASVC Radars.....$39.95
- CRV-14AAS Phantom Antenna for Transmitters up to 400 MC.....$11.75
- 3 CM Pickup Horn Antenna, AT-48/UP.....$8.95
- I-138A Signal Generator—10 cm.....*$185.00
- BC-221 Frequency meter.....$195.00
- BC-221 Freq. Meter (with modulation).....*$125.00

All items New Except Where noted * (Exc. Used Condition)

MISCELLANEOUS EQUIPMENT

Amperex 1B88 Gamma Counter.....$ 9.87
Powerstat 1226—115/230V Input—0-270V out @ 9 amp.....37.00
EIMAC 35T Ionization Gauge.....5.95
ATR Inverters 6VDC to 110 VAC 60 cy 75W.....22.95
ID-6/APN-4 Indicator.....49.50
R-7/APS-2 Receiver.....49.50
R-78/APS-15 Receiver.....49.50
FL-8 1020 cycle Filter.....2.85
RM-29 remote control unit.....8.95
RM-14 remote control unit.....8.95
RTA-1B 12/24 V dynamotor.....40.00
BC-1206-CM2 Receiver.....12.95
CY-230/MPQ-1 Radar Console.....$75.00
ASB-4 Radar equip. Complete.....68.75
T-9/APQ-2 less tubes.....18.50
RCA AVR-15 Beacon Recvr.....18.50
TBY Trans-Recvr.....29.95
Pioneer Type 800-1B Inverters—28VDC to 120V 800 cy 7 amp AC (used).....22.65
G.E. Inverter—28VDC to 120 VAC 800 cy 750VA I.P.....39.50
Navy SD-3 Radar complete.....$200.00
Navy DP-14 Direction Finder complete.....$85.00

PULSE TRANSFORMERS

UTAH 9282 9275 9280

UTAH 9818 9340 9350

G.E. 58G-827	Westinghouse 232-AW2
G.E. 58G828	Westinghouse 232-BW-2
G.E. 58G829G1	AN/APN-4 Block Osc.
G.E. 58G13	Philco 352-7140
G.E. K-2469A	Philco 352-7150
G.E. K-2744B	Philco 352-7071
AN/APN-9 (901756-501)	Philco 352-7178
AN/APN-9 (901756-502)	Raytheon UX-7380
AN/APN-9 (352-7250)	W.E. D-161310
AN/APN-9 (352-7251)	W.E. D-163247
Westinghouse 132-AW	W.E. D-163325
Westinghouse 139DW2F	W.E. D-164881
Westinghouse 187AW2F	W.E. KS-9563

AN/APA-23 RECORDER

Sweeps any receiver through its tuning range and permanently records frequency and time of received signals on paper chart. Power input—(motor) 27V DC 1.5A, and (rewarder) 60/115V AC 60-2800 cy 135W.

Originally designed to record pulse or sine-wave modulated signals received by AN-APR-1, AN/APR-2, AN-APR-4, AN/APR-5, BC-348, S-27, SX-28. BRAND NEW.....$147.50

SPRAGUE PULSE NETWORKS

7.5 E3-1-200-67P, 7.5 KV, "E" Circuit 1 Microsec. 200 PPS, 67 ohms Imped. 3 sections.....$4.30
7.5 E3-3-200-67P, 7.5 KV, "E" Circuit 3 microsec. 200 PPS, 67 ohms Imped. 3 sections.....$6.75
7.5 E4-16-60-67P, 7.5 KV, "E" Circuit 4 sections, 16 microsec. 60 PPS, 67 ohms Imped.....$8.25
15 E4-.01-400-50P, 15KV, "E" circuit .01 microsec. 400 PPS, 50 ohms Imped. 4 sections.....$10.50
15-A-1-400-50P, 15KV, "A" Circuit, 1 microsec. 400 PPS, 50 ohms Imped.....$37.50
15 E7-2-200-50P, 15KV "E" Circuit, 2 microsec. 200 PPS, 50 ohms Imped., 7 sections.....$42.00

LECTRONIC RESEARCH LABORATORIES
715-19 ARCH ST. PHILA. 6, PA.
Telephones - MARKET 7-6771-2-3

LECTRONIC RESEARCH

GUARANTEED BRAND NEW

TUBE SPECIALS

STANDARD BRANDS ONLY

Receiving Tubes	
OOA	$1.50
01A	.67
OZ4	.74
OZ4A	.98
1A3	3.85
1A5GT	.72
1A6	.99
1A7GT	1.10
1AB5	.96
1B3GT	.99
1B4P	1.17
1C8GT	.99
1C6	.69
1C7G	.69
1D8GP	.69
1D7G	.69
1D8GT	1.17
1E5GP	1.17
1F4	.69
1F5G	.69
1G4GT	.69
1G5G	.69
1G6GT	.69
1H4G	.89
1H5GT	.74
1H6G	.99
1H6GT	1.10
1J6G	.99
1J6GT	1.10
1L4	.74
1LA4	1.10
1LA6	1.10
1LB4	1.10
1LC5	.99
1LC6	1.10
1LD5	1.10
1LE3	1.10
1LH4	1.10
1LN5	.91
1N5GT	.93
1N6G	.97
1P5GT	.99
1Q5GT	.99
1R4	.69
1R5	.75
1S4	.93
1S5	.93
1T4	.93
1T5GT	.99
1U4	.93
1U5	.81
1V	.86
1X2	1.29
2A3	1.28
2A5	.79
2A7	.89
2B7	.79
2E5	.94
2X2	.88
2X2A	1.85
3A4	.65
3A5	1.89
3A8GT	2.25
3B7	.69
3C6	1.15
3D6	.69
3LF4	1.10
3Q4	.93
3Q5GT	1.10
3S4	.93
3V4	.93
5AZ4	.69
5T4	1.92
5U4G	.69
5V4G	1.25
5W4	.82
5X4G	.87
5Y3GT	.89
5Y4G	.75
5Z3	.87
6Z4	1.28
6A3	2.39
6A4	1.35
6A6	1.17
6A7	1.05
6AB4	.99
6AC7	1.39
6AC7W	3.25
6AD4G	.98
6AD7G	1.39
6AE6G	.89
6AF4G	1.19
6AG5	1.19
6AG7	1.59
6AH6	1.56
6AJ5	2.50
6AK5	1.85
6AK5W	3.85
6AK6	.99
6AL5	.69
6AL5W	2.50
6AQ5	.89
6AQ6	.79
6AS6	3.65
6AS7G	6.85
6AT6	.63
6AU6	.69
6AV6	.63
6AW6	.79
6B4G	1.60
6B5	1.20
6B7	1.19
6B8	.99
6BG6G	1.92
6BH6	.99
6BQ6GT	1.26
6C4	.65
6C5	.75
6CB6	.99
6C6	.88
6CD6G	1.35
6CD6G	2.40
6D6	.82
6E5	.99
6F5	1.10
6F5GT	.83
6F6	.79
6F6G	.99
6F7	1.05
6F8G	1.40
6G6G	.89
6H6	.83
6H6GT	.83
6J5	.75
6J5G	.64
6J5GT	.64
6J6	1.19
6J7	.99
6J7GT	.79
6J8G	1.28
6J8GT	.99
6K6GT	.69
6K7	.88
6K7G	.79
6K8	1.22
6K8GT	.96
6L6G	1.06
6L6	2.13
6L6G	1.99
6L6GA	1.75
6L7	1.95
6L7G	.95
6N7	1.44
6N7GT	1.29
6P8GT	.96
6Q7	.99
6Q7G	.99
6R7	.99
6S7	1.06
6S7G	.99
6SA7	.79
6SA7GT	.89
6SB7Y	1.05
6SC7	1.25
6SC7GT	1.05
6SD7GT	1.10
6SF5	.82
6SF5GT	.88
6SF7	.69
6SG7	.91
6SH7	.89
6SH7GT	.99
6SJ7	.89
6SJ7GT	.89
6SK7	.89
6SK7GT	.89
6SL7GT	1.05
6SN7GT	.89
6SN7WGT	2.30
6SQ7	.78
6SQ7GT	.78
6SR7	.81
6SS7	.99
6ST7	1.25
6T7G	1.99
6T8	1.28
6U5	1.19
6U7G	.88
6V6	1.40
6V6G	.89
6V6GT	.79
6W6GT	.72
6W6GT	.99
6X4	.59
6X5GT	.59
6Y6G	1.19
6ZY5G	.89
7A5	1.05
7A6	.89
7A7	.89
7A8	.89
7AD7	1.44
7AH7	1.05
7B4	.89
7B5	.89
7B6	.89
7B7	.89
7B8	.89
7C4	.99
7C5	.99
7C7	1.05
7D5	1.28
7E5	.79
7E7	1.05
7F7	1.05
7F8	1.59
7G7	1.32
7H7	.99
7J7	1.32
7K7	1.32
7L7	1.32
7N7	1.60
7Q7	.99
7S7	1.32
7V7	1.32
7W7	1.32
7Y4	.89
7Z4	.89
10	.45
12A	.79
12A6	.89
12AH7GT	.79
12AT7	1.16
12AU6	.79
12AU7	.79
12AV6	.63
12AX7	1.05
12BA6	.72
12BA7	.95
12BE6	.78
12K8	1.49
12Q7GT	.89
12SA7	.89
12SA7GT	.89
12SF5	.79
12SF5GT	.79
12SK7	.79
12SQ7GT	.89
12SR7GT	.79
12X4	.89
12Z3	.89
14A4	1.32
14A7	1.09
14B6	1.09
14B8	1.09
14C5	1.29
14C7	1.18
14E7	1.29
14F7	1.09
14H7	1.18
14J7	1.29
14N7	1.29
14R7	1.29
14S7	1.29
14W7	1.29
14X7	1.29
19	.89
19T8	1.16
21A6	1.16
24A	.79
25A6	1.16
25L6GT	.89
25Z5	.99
26	.79
27	.69
28D7	1.30
30	.72
30 Spec.	.48
31	.52
32	.99
32L7GT	1.29
33	.99
34	.99
35 .51	.79
35A5	.89
35B5	.99
35L6GT	.89
35W4	.85
35Y4	.89
3524GT	.89
35Z5GT	.89
36	.69
37	.69
38	.69
39/44	.89
41	.99
42	.89
43	.89
45	.89
45Z5GT	.79
46	.99
47	.99
48	1.40
50	1.41
50A5	1.09
50B5	.88
50C5	.88
50L6GT	.79
50Y6GT	.92
53	.98
55	.99
5Y3GT	.89
5Z3	.89
5Z4	.89
6AB5/EL-6AB5	.52
6C4	.69
6C4S	17.50
6C5S	28.75
6C6S	23.75
6CB6	9.95
6CD6	4.95
6CL6	122.50
6D6	14.50
6F4-A	4.95
6F5	7.85
FG-95/ 5560	28.00
FG-104/ 5561	24.60
FG-108	19.50
FG-166	6.00
FG-172	39.50
FG-178	14.50
FG-228A	4.95
FG-238A/ 5552	94.50
FG-271/ 5551	62.50
393A	6.75
394A	4.77
GL-415/ 5550	39.50
KU-610	12.50
KU-620	29.50
KU628	22.25
KU-634	39.50
WL-652/ 5559	62.50
WL-654/ 659	82.00
WL-672	22.50
WL-677	39.50
WL-681/ 5560	39.50
722A	3.75
884	1.85
885	1.90
1625	11.80
1904	13.95
2050	1.80
2051	1.15
5545	32.50

Transmitting & Special Purpose Tubes

OA2	$1.69
OA5	1.51
OB2	1.88
OD3	1.29
QC3	1.29
OD3	1.15
1B21A	2.85
1B22	2.25
1B23	9.95
1B24 (West)	12.95
1B24 (Style)	18.95
1B26	3.75
1B27	19.50
1B29	2.90
1B32	3.95
1B30	12.50
1B36	12.50
1B42	9.80
1B20	.88
1S21	9.85
1Z2	3.75
2B22	2.20
2C21	.75
2C22	.75
2C26	.49
2C26A	.49
2C34	.65
2C39	22.00
2C40	8.95
2C42	26.50
2C43	22.50
2C44	1.50
2C46	29.50
2C51	5.75
2E22	1.85
2E24	4.10
2J21A	9.95
2J22	9.95
2J26	26.50
2J27	26.50
2J31	39.50
2J32	42.50
2J33	59.50
2J34	59.50
2J36	85.00
2J37	13.75
2J38	17.50
2J39	49.50
2J48	39.50
2J41	175.00
2J48	27.50
2J49	45.00
2JB51	2.50
2J55	87.50
2J56	150.00
2J61	45.20
2K23	37.50
2K25	33.50
2K26	135.00
2K28	34.50
2K29	26.00
2K33	295.00
2K45	145.00
2K54	135.00
2K55	135.00
2X2A	1.85
3B22/ EL-1C	2.95
3B23	4.75
3B24	5.25
3B24W	7.95
3B25	4.50
3B26	3.75
3B27	3.95
3C24	1.95
3D21A	1.96
3E29	14.50
3J31	95.50
4-125A	29.50
4A1	1.18
4B22/ EL-5B	$ 8.95
4B24	5.75
4B25/ EL-6CF	8.95
4E27	17.25
4J36	150.00
4J38	120.00
4J50	375.00
4J52	600.00
5D21	26.50
5J23	24.50
5J29	18.50
6-5B	.85
6AR6	3.35
6C21	29.50
6C24	52.50
6J4	7.95
7-7-11	1.19
10T1	.88
10Y	.45
15E	2.35
15R	.95
REL-21	2.25
24G	1.85
RK-28	3.82
FG-32/ 5555	6.75
RK-34	.49
35T	4.95
35T (Ion Gauge)	.88
35Z5	4.95
354C	19.50
356B	5.45
361A	4.75
371A	.95
371B	.95
388A	2.95
WE-399A	4.79
417A	16.95
434A	17.50
435	4.95
446A	1.95
446B	2.25
450TH	42.50
450TH	42.50
451	1.39
471A	.95
531A	2.75
SS-501	12.50
542AX	1.45
566AX	1.45
707AX	1.47
527	12.25
528	17.50
531	8.25
532A	3.95
WL-533	115.00
561	3.50
HY615	.49
WL-570A	8.50
700A	24.50
700B	24.50
700C	24.50
700D	24.50
702A	2.95
702B	4.25
704A	4.95
705A	2.75
706AY	45.00
706BY	45.00
706CY	45.00
706FY	45.00
706GY	45.00
707A	9.95
707B	22.50
708A	4.25
709A	4.87
710A	1.70
714AA	12.15
714AY	4.95
715A	6.75
715B	12.75
715C	24.50
717A	1.47
718AY	45.00
719AY	4.75
WE-719A	26.50
720DY	75.00
721A	4.90
723A	4.95
723A/B	16.95
724A	3.22
724B	3.22
725A	3.95
726A	8.50
730A	25.00
731A	2.45
WL-787	9.50
798Y	1.60
800	1.50
801A	.48
803	3.87
804	8.95
805	4.50
806	24.50
807	1.79
808	2.65
809	2.49
810	10.95
811	3.95
813	9.50
814	3.95
815	2.75
816	1.45
826	1.45
828	1.45
829	9.96
829A	14.50
829B	16.50
830B	2.95
832	7.95
832A	9.95
836	2.50
837	1.58
838	3.25
841	.49
845	.49
845	5.75
849	29.50
851	69.00
852	22.60
860	4.95
861	24.60
864	.39
865	1.25
866A	1.45
867B	28.00
872A	2.95
874	1.45
876	1.45
878	1.85
954	.39
955	.49
956	.49
957	.49
958A	.49
959	.49
1602	2.25
1612	2.70
1613	.98
1614	2.00
1616	1.97
1619	.39
1622	2.30
1624	1.95
1625	.45
1626	.39
1629	.39
1630	.45
1631	1.38
1636	3.10
1638	.79
1641	1.95
1642	.79
1644	1.17
1658	1.98
1960	.79
5611	135.00
5654	5.85
UX-6453	.65
7193	.75
7475	5.50
8011	.87
8012	2.60
8013	2.75
8013A	4.50
8014A	29.50
8020	1.39
8021	6.50
9001	1.75
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Continental Motor Generator Sets, Type DS-445X, operative at 230 Volts DC, 1800 RPM, stab. sh. output 25 KVA, .5 P.F., 120 volts, 3 ϕ, 60 cy., weight app. 1600 lbs., rebuilt, price $600.00

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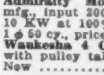
HERE IS EXCEPTIONAL VALUE

Robins and Myers Motor Generator Units. Operate at 110 Volts, AC, single phase, 60 cys, and deliver 32/40 Volts, DC. Can be used with field rheostat to supply 24/28 VDC for the operation of aero equipment from lighting line. Rated at 40 watts but will deliver 250 watts for intermittent operation. Gear head built into one end rotates external shaft at 225 RPM. An exceptional value at $18.75 each. With field rheostat $20.00. Also available for operation at 115 VDC at $12.50 and with rheostat at $13.75 each. Both units have 1/4 HP Motor. Stock up on these sets while they are available. Special price on quantity. Rebuilt.

CENTURY MOTOR GENERATOR SETS

7.5 KVA: 230 Volts, DC to 115 Volts, AC, single phase, 60 cycles. Complete with automatic controller and push button station.....$445.00

KATO ROTARY CONVERTERS



Type 1205A Model 26KA54 Input: 24 VDC 28A. 1800 RPM. Output: 115 VAC 1 phase, 60 cy. 1.4 KVA. Compact and ruggedly built for cont. duty oper. Filtered. Shock mounted. New **$90.00**

New 1 HP. GAS ENGINE

Air cooled lightweight aluminum construction (18 lbs.) 2700 to 3800 R.P.M., Precision built, covered by manufacturer's warranty, 1 cylinder, 2 cycle.....$29.00

Marathon Generators can be used with above engine, have output of 110 Volts AC. 1 ϕ 60 cy. 300 Watts, rebuilt, self-exc. Price $42.50

Century Repulsion Induction Motor, type RS, 1/6 HP, 110 or 220 Volts, 1 ϕ 1750 RPM, rebuilt $6.90

General Electric, DC motor, Type SD, 1/30 HP, B.B., 110 Volts, .7 amps. sh. wdg., price $3.35

G. E. DC Motor, type BY, 1/17 HP, 2100 RPM, sh. wdg., BB., price $3.00

ESCO DC/DC Motor Generator Units

Operate at 220 Volts, DC to deliver 110 Volts, 2.5 amperes. Two of these units can be used on 220 VDC to obtain 110-0-110 Volts DC. **Special Price** $18.50

GENERAL ELECTRIC DC/AC MG SETS

Four Bearing Marine Units: 25 HP 230 Volts, DC coupled to alternator 18.75 KVA; 80% PF; 1800 RPM. Output: 115 Volts, AC. Single Ph; 60 cycles. Ball Bearings. Ideal set; marine duty. Brand New $545.00

PINCOR ROTARY CONVERTERS

300 VA; Filtered; Brand New. Input: 115 VDC. 4.2 Amp. Output: 230 VAC, 1.36 Amp. **SPECIAL PRICE** $58.00

MARATHON MOTOR GENERATORS

Input at 110 VDC Output 110VAC, 1 phase, 60 cy. 500 VA. Marine Type with voltage regulator and frequency controller. Rebuilt LN $75.00

Same unit as above with 32 VDC Input and 300 VA Output $64.00

WESTINGHOUSE MOTOR

#1171198—1.4 Horse Power 21 Volt, 70 Amps. 1800 RPM Pump mounting on each end Ball bearing, compound wound 18" L x 8" H x 7" W. **BRAND NEW**.....$19.75

General Electric Synchronous Motor or Alternator; excitation 2 Volts; operating at or delivering 110 volts, 3 phase, 60 cycles at 1800 speed; no name plate, but lab tests determined specs as above $9.95

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110 VA. Input: 110 VDC; Output: 110 VAC, single phase, 60 cycles; 3600 speed. With filter for elimination of radio interference. Reliably Rebuilt. Special Price.....$19.95

TAPE WINDERS

These tape winders consist of a motor operative at 110 volts D.C., .6 amperes; 1800 speed. A motor which is separable from the rest of the unit and which can be employed for a multitude of purposes, alone or with the gear reduction box to which it is connected. Motor is shunt wound and the speed thereof is controlled by a built-in rheostat. This makes an invaluable laboratory unit. Special Price **$10.95**

G. E. ROTARY CONVERTERS

Dynamotor Model 5D46AB8 78 Volts, DC input to deliver 110 Volts, AC, single phase, 60 cycles, 1.5 amp. **SPECIAL PRICE (Rebuilt) $9.95**

G. E. OIL FILLED OUTDOOR TRANSFORMERS

Brand New. 3 KVA; Type HS 3000/5200Y-115/230. Also 6000/10,400Y-115/230. Brand New. Either type Special $44.00

WE CAN FURNISH M.G. SETS OF ANY SPECIFICATIONS FOR ANY APPLICATION. SEND US YOUR REQUIREMENTS.

GE LOW VOLTAGE MG SETS. Motor: 1 HP, 220/440-3-60 direct conn. to Gen. 500 watts, 18-28 VDC, with control panel including field rheo. ammeter and voltmeter. PRICE **$150.00**

ALLIS-CHALMERS MG SETS. Input: 230 VDC,7 amp. 3600 RPM, BB, Output: 115 VDC, 1.25 KVA, 1ϕ, 60 cyc. Centrifugal automatic controller permits line-start operation. Fully enc. Rebuilt like new. Price.....$85.00

GE LOW FREQ. MG SETS. Motor: 230 VDC 3 HP, 860 RPM 12 amp. Direct conn. to Alternator: 110 Volts, 1ϕ, 15 cycles. 21.8 amp. 2.4 amp. self. exc. Price.....$385.00

DC GRINDERS. Made by US Motors. 230 VDC, 1 HP. 1750 RPM. Double shaft. With thermal overload protection and switch. Rebuilt. Latest style.....$34.50

Newark Transformers, 3.3 KVA, 550/110 Volts. PRICE $49.75

G. E. Autotransformers. 500 VA. 110-220 Volts, for wall mounting. PRICE NEW $17.35

Raytheon Transformers. 750 VA. Pri: 220/440 Sec: 110. PRICE.....$22.00

LV MOTOR GE GENERATOR Motor: 550/3/60, 25 HP direct connected to 27 V, 550 amps., 15 KW Generator. Price.....$675.00

LV ESCO DC MOTOR 26.8-28.2 V, 212-122 A, 7 HP, 1800 RPM, BB. Price.....$195.00

SELSYN MOTORS GE MODEL 5MJ365AK1, RPM 1200/400, primary stator 440/3/60, 3 KVA, 16 A, secondary rotor 93.5 V, 54.5 A, 32.8 FT.LS. Price.....$225.00

LV MG SET GE Motor: 110/220/1/60, ¾ HP, direct connected to Generator 12 V, 27 amps. Price $125.00

ESCO LV CONVERTER Pri. 32 VDC, 8 A, Sec. 110/1/60, 150 W, 1800 RPM. Price.....$58.50

GE HV MG SET Motor: 230/440/3/60, direct connected to Dc Gen. 5000 V, 2.5 A, 20 KW, 1800 RPM. Price.....$675.00

LV GE MG SET Motor: 220/440/3/60, 1 HP, 1800 RPM, direct connected to DC Gen., 24V, 18 A, complete with rheostat and voltmeter and ammeter. Price $175.00

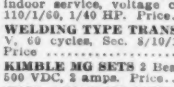
With single phase motor.....$225.00

VOLTAGE REGULATOR GE, MOTOR CONTROL Cat. #837625, Type AIRS, .565 KVA, 60 cycles, primary volts 115, low amps. 16.2, Indoor service, voltage controlled by motor 110/1/60, 1/40 HP. Price.....$39.50

WELDING TYPE TRANSFORMERS Pri. 440 V, 60 cycles, Sec. 8/10/12 V, 10,000 watts. Price $150.00

KIMBLE MG SETS 2 Bear. B.B., 220/3/60 to 500 VDC, 2 amps. Price.....$165.00

ESCO DC/AC MG SETS Motor: 12 HP, 230 VDC, 51 amps., driv. connected to Alternator: 440 V, 2 phase, 60 cycles, brand new. Price $545.00



WESTINGHOUSE M-G UNITS

Compact two bearing units consisting of a repulsion-induction motor, type 3H; 110/220 volts, single phase, 25 cycles, 1425 rpm. 5.4/2.7 amperes. Continuous duty. The generator has a rating of .08 KW, 40 volts, 2 amperes, D. C. Compound winding, type FK. Rebuilt like new. Price $22.50

ESCO CONVERTERS

Rebuilt like new. Input: 36 VDC 2.85 amp. 3600 R.P.M. Output 115 VAC, 2.18 amp. .50 P.F. Ball Bearings. Base for table or side mounting. Special $9.80

GENERAL ELECTRIC 8 KW High Voltage Generators; Rebuilt like new, double commutator type each rated at 4000 Volts, DC, 2.5 amperes; can be connected in series to give 8000 Volts, DC at 2.5 amperes or 4000 volts, 5 amperes in parallel. Separately excited. Units weigh about 800 pounds. Offered at a fraction of their original cost.....$175.00

KUHLMAN OIL COOLED TRANSFORMERS. 230 Volt primary to 115/230 Volt secondary; 1½ KVA. Brand New in original cases. SPECIAL PRICE $32.50

Janette Rotary Converters. 12 volts DC to deliver 110 volts, AC. Rated: 212 VA. With radio filter.

Special Price ...$72.00

Special Series Motors; no name plates, ¼ HP operate at either 110 Volts DC or AC; ⅝" shaft. Reconditioned.....$8.85

RAYTHEON VARIABLE VOLTAGE TRANSFORMER. Primary: 220 volts, 3 phase with output by selector snap switch giving voltage outputs from 140 to 220. Brand new. Price $35.00

WESTINGHOUSE TRANSFORMER CONTROLLER. Contains 300 watts, 120-220 volt transformer with multi-taps. The transformer with tap switch alone is worth more than the special price.....$7.50

Esco AC Motors: built-in magnetic brake for quick reversing. Double shaft, ball bearings. Rated: 2¼ HP—30 minutes, marine duty: 440-3-60. Brand new in original cases. **SPECIAL PRICE** $37.50

ESCO DC/AC MG SETS. Motor: 115 Volts, 1¼ HP line start; built in voltage regulator, frequency control, filtered; ideal for television, radar or any application requiring constant voltage and frequency. Output: 115 V.A.C. 1 ϕ, 60 Cyc. 460 V.A. Brand New.....$120.00

Watthour Meters. 110/110 Volt DC operation. Used but in A1 condition. 5 amp.....$2.75 10 amp ..$4.35 15 amp..$5.00 25 amp..$6.00

Crompton-Parkinson Alternators. 3 KVA. .7 PF. 110 VAC, 1ϕ, 60 cyc. 1800 RPM. sep. exc. Price $170.00

DC Manual Controllers, mfg. by Marconi Co. of England. Enc. type. For starting duty of 24 VDC Motors, rated at .7 HP. A really hard-to-get unit at a give-away price. SPECIAL $4.00

PIONEER DYNAMOTOR. Type PS350. Input: 12 VDC, 4.9 amp. Output: 350 VDC, .100 amp., brand new. Price.....$14.00

BRITISH DC/AC MG UNITS. Operate at 100/110 VDC, 4 amps., 3000 RPM. Output: 230 VAC, .87 amp., 50 cyc. Wt: 132 lbs. Brand new. Price $42.50

With field rheostat for 60 cycle output. Price $50.00

G.E. 3 PH. TRANSFORMERS. 3 KVA, 418/429/440 Pri. 140 volts, 3 ph. Sec. Price..$45.50

GE Relays: 110 VAC—10 Amp. 60/60 cy. in steel case 5 x 5 x 6½.....$3.00

GE DC Generators. Consists of three separate generators in one unit. 3600 RPM. Delivers 1200 V., 450 V. .25 a. and 115 V. 1.3 amp. Price $24.00

G.E. Motor Starting Reactors Type 11KR240G2: Rated at 440 V. 3 Ph. 60 Cy. 16.3 Amp. Only a 3 Pole Double Throw Switch is necessary with this unit to make a 15-20 HP compensator starter. Useful for any purpose requiring three phase choke. **SPECIAL PRICE..$25.00**

GAS-DRIVEN GENERATORS

Mfgr.	Cap.	Volts	Price
Airco	2500 W	115/230/1/60	$395 NEW
Airco	500 W	115 VDC	$125 NEW
Onan	5 KW	115/1/60	$550
Duplex	7½ KW	115/1/60	$699
Contin.	3 KVA	110/3/60	$475

H.V. M.G. SET—6 Hp. 220/440 V motor direct coupled to 2000 VDC, 2KW generator...PRICE $275.

GE AIR-COOLED TRANSFORMERS

New. cat. 61G29 460/230-230/115 1 KVA..$13.50

IF IT'S FROM ONE FREQUENCY TO ANOTHER; FROM DC TO AC OR AC TO DC, IF IT'S FROM ONE VOLTAGE TO ANOTHER, THEN CALL ON US.

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HIGH FREQUENCY CONVERSION EQUIPMENT

GENERAL ELECTRIC HF MG SETS. Motor 120 VDC Generator: 115 VAC, 1ϕ, 1050 cy. 2 KVA. 2 Bear. BB unit. Price $220.00

ONAN 400 CYCLE MG SET. Motor: 230V, 3ϕ, 60 cy. V belted to self-excited alternator with output of 4 KVA., 115 Volts, single ph. 400 CPS. Mounted on base with voltage regulator connected. Components all brand new .....PRICE, $712.00

PE118 Units: Operate at 28 VDC, 100 Amp. Output: 115 VAC, 1ϕ, 400 CPS, 1500 VA. with filter system built-in .....PRICE, $29.50

THREE PHASE 400 CYCLE SETS. Consist of motor operative at 220/440-3-60 V belted to self excited alternator made by Holtzer-Cabot with output of 500 VA. 115 VAC, 3ϕ, 400 cycles.....PRICE $295.00

BOGUE THREE PHASE MG SETS. Consist of Motor operative at 220/440-3-60, Self-exc. alternator with output of 120/208V. 3ϕ, 400 cyc. 5 KVA. Brand New .....PRICE $1850.00 With Voltage Regulator.....PRICE $1950.00

KATO 400 Cycle 3ϕ. Consists of Synchronous motor V Belted to self excited Alternator with output of 120/208 V. 3ϕ. 400 v, 40 KVA. W/motor compensator. PRICE $4990.00

5 KVA BRITISH MG SETS. Motor: 7½ HP. 220-3-60 V belted to self exc. alternator with output of 115 Volts, 1ϕ, 400 cycles .....PRICE, $975.00

BRITISH DC/AC MG SETS. Input 230 VDC. Output 180 VAC, 1ϕ, 500 Cyc. 5 KVA.....PRICE, $265.00

50 KVA MG SETS. Mfg. by GE. Consist of Motor: 75 HP. 220/440-3-60 cycle sheet connected to Alternator with output of 50 KVA: 115 Volts, single ph. 400 CPS complete with auxillary exciter MG set, field rheostat and starting compensator.....PRICE $5950.00

HIGH FREQ. UNIT. Motor: 24 VDC 50 amp. Alternator: 17 VAC, 1300-1600 cyc. sgc. at 24 VDC. 1.25 BHP. 4000 RPM. Made in Canada by Electric Tamper & Equ.....PRICE, $49.00

H.F. MOTOR GENERATOR, G.E. Model 5LY126A4. Motor: 115 VDC direct connected to Generator 24-32 VDC, 75 amps., and to alternator 120VAC, 720 cycles, 1 ph. KW-3½.....PRICE, $245.00

ELECTRIC SPECIALTY FREQUENCY CHANGERS Type BFR85/BFR8334 Input: 220 Volts, 3 Ph. 60 cy. 3600 RPM. Output: 250 Volts, 20 Amps, single ph. 180 Cyc. 5000 VA. 3000 Watts. Brand New. Compact ball bearing units for operation of Hi-cycle equipment. SPECIAL PRICE $1000.00

ONAN 800 CYCLE MG UNIT. Employing 5 H.P. Motor operative at 220/440 Volts, 3ϕ, 60 Cy. V belted to self-exc. generator with output of 1.5 KVA. 115 Volts, single ph. 800 CPS, and secondary output of 500 Watts 28.5 VDC 17.5 amperes. PRICE.....$289.00

ECLIPSE 800 CYCLE GENERATORS. Flange mounting with spline shaft. Output is 115 VAC 10.4 Amp 90% P.F. 800 Cycles, 1200 V.A. with secondary output of 28.5 VDC, 60 Amperes. Self excited. Price $39.00

BRITISH MADE 500 CYCLE MG SETS. Motor: 230 Volts, 3 PH—50 Cycles. Alternator: 5 K.W. 180 Volts, 27.8 Amp. 500 Cycles. Excitation—110 VDC. When used at 60 Cycle current. Output is 600 cycles, 220 Volts. Price $353.00

WINCHARGER PU-7/AP; Input: 28 VDC, 160 Amps. Output: 115 VAC, single ph., 3500 V.A. 400 C.P.S. Frequency and voltage regulation built-in. Price $87.00

WESTINGHOUSE HIGH FREQUENCY UNITS. Input: 115 Volts, D.C. 2.7 Amps. Output: 14.4 Volts, .130 Amp. 450-3850 Cycles. Frequency variation is obtained with built-in controller on end of unit. Price $48.50

GE DUAL OUTPUT MG SETS. Consist of Motor rated 5 H.P. 220/440 V. 3ϕ, 60 Cy. directly coupled to 2 generators. Output .5 K.W. 220 Volts, 2.27 Amp. 525 Cycles. Also .5 K.W. 110 Volts, D.C. 4.55 Amp. 3 separate units mounted on common bed plate. Price $150.00

WESTINGHOUSE 180 CYCLE ALTERNATORS. 750 V.A. Output: 110 Volts, 3 Phase, 180 C.P.S. 3000 R.P.M. Separately excited at 110 VDC. Price..$44.00 Also available with built-in exciter. Price.....$78.00

GENERAL ELECTRIC HIGH FREQUENCY UNIT. Operating at 440 3-60 .75 amp. Output: 110 Volts, 3 ph. 148 cyc. 220 Watts, 1.8 amperes. An ideal unit for experimental work or for operation of equipment. SPECIAL PRICE $34.50

BENDIX-ECLIPSE 800 CYCLE AERO UNIT. Input: 24-28 VDC, 75 amps. Output: 115 V. 10.5 Amp. 800 C.P.S. Complete filter system mounted thereon. Price $22.50

INVERTER UNIT PE206A. Input: 27.5 VDC. 28 amp. Output: 80 Volts, single ph. 800 CPS. 500 VA. Price $19.00

RLX DUAL GENERATORS. Flange mounted. Output: 500 Watts, 1300-2600 Cycles, also 13-14 VDC 750 Watts. Price $25.50

ELECTRIC SPECIALTY HIGH FREQUENCY CONVERTER UNIT. Primary: 32 VDC, 16 amperes, 3000 R.P.M. Ball Bearings. Secondary: 350 volts, 1500 cycles, .75 amps. 275 V.A. Single Ph. Built-in frequency control. Specially Priced at.....$50.00

BENDIX POWER MG SET. Consists of G.E. 2 HP Rep-Ind Motor, 115 volts, single phase, 60 cyc. directly connected to Bendix alternator with output of 120 volts, 700 cyc., 600 watts and DC output of 14.5 volts, DC, 23 amp. Brand new. Price $225.00

LOUIS-ALLIS 3 UNIT MG SET. Consists of 5 HP motor operative at 220/440-2-60 directly coupled to alternator with output of 115 volts, 1 ph., 400 cyc. and with exciter unit all mounted on steel base. Price $365.00

LOUIS ALLIS FREQUENCY CHANGER SETS.
Pri: 25 H.P., 220/440-3-60; Sec. 15/10.8 K.W. 3300/2200 RPM. 366/220 Volts 35/35 Amps. 2 ph. 500/360 C.P.S. Price $1050.00

Pri. 10 H.P. 220/440-3-60; Sec: 7.5 K.W. 440/220 V. 17/8 Amp. 3000/1200 RPM. 360/180 Cycles, 2 ph. Price $750.00
We can supply these units for 400 cycle output and with transformers to supply 3 phase, wye output. Write for further information.

CONTINENTAL DC/AC SET. Motor: 1.5 HP, 230 VDC, 1440 RPM. Output: 120 VAC, 0.6 amps., 8 KW, 800 cyc., 1 ph., also output of 14 VDC, 4 amps., Model CG21637. Compact 2-bear. units. Completely rebuilt. Price $89.00

WINCHARGER PU-16/AP INVERTER. Type MG750. Input: 28 volts, 60 amp. Output: 115 volts, 6.5 amp., 400 cyc., 1 ph. Brand new. Price $69.50

HOLTZER-CABOT MG 224. Compact 2 bear. units for low current 400 cyc. Operates at 32 VDC, 0.5 amp. Output: 110 volts, 1.0 amp., 1 ph., 100 watts, 400 cyc. Brand new. Price $69.50

HOLTZER-CABOT MG 218. Operates at 115 VDC, 2.3 amp. with same output. AS MG 221.....$79.50

LELAND INVERTER TYPE MG 4A. DC Input: 27.5 to 28 amp., 4000 RPM. Output: 115 volts, 1 ph. 400 cps., 500 VA. Like new and fully guaranteed. Price $39.50

GENERAL ELECTRIC MODEL 5D21N13A. Input: 27 volts, 85 amp. Output: 115 volts, 435 VA, 1 ph., 400 cyc. Price $31.50

ESCO DUAL FREQUENCY UNITS. Motor operates at 120 VDC, 10 amperes. Delivers 70 Volts at 120 Cycles or 200 Volts at 720 Cycles. Price.....$95.00

GE MG UNITS. Motor: 110 Volts, D.C. 31.8 Amperes in a single compact unit with output of 120 Volts, 20.8 Amp. single ph. 500 cycles. Like New. Price.....$95.00

CROCKER-WHEELER 500 CYCLE SET. Operate at 110 Volts, D.C. 29.6 Amps. Output: 120 Volts, single ph. 500 cycles 2.5 KW. Price $140.50

HOLTZER-CABOT TYPE CAJ-211168 MG UNITS. Compact 2 bear. operative at 115 volts, 1 ph., 60 cyc., ½ HP. Output: 115 volts, 4 amp., 233 cyc., 2 ph., also 24 VDC at 5 amp. Brand new. Price.....$35.00

NORMAND ELEC. CO. (BRITISH MFG.) MG UNIT. Motor: 230 VDC, 8.8 amp., 2 HP, 4200 RPM, directly connected to H. F. alternator with output of 1400-2800 cyc. 1200 watts. Exc. 24 VDC. Price $70.00

MARCONI MG UNIT. ¼ KW, operates at 110 VDC to deliver 110 VAC, 200 cyc., supplied with field rheostat for variable frequency output. Price $70.00

PIONEER MG UNIT. Input: 115 VDC, 2.4 amp. Output: 140 VAC, 1.2 amp., 350 cyc. Complete with field rheostat for variable frequency output. Price $80.00

ESCO MG UNIT. Operative at 120 VDC, 35 Amp., 4 HP. Delivers 115 VAC, 1 ph., 1600 cyc., 2 KW. An exceptionally fine machine for laboratory use. Can be used with field rheostat for frequencies up to 2000 cycles. Price $175.00

ESCO INVERTER UNIT. Prim: 12 VDC, 90 amp., 1800 RPM. Sec: 140 VAC, 1 amp., 140 VA, 360 cyc. With field rheostat for frequency outputs up to 600 cyc. Price $69.50

HOLTZER-CABOT MG UNIT. Operates at 115 VDC, 8.2 amp. to deliver 55 VAC, 6 amp., 195 cyc., 3 ph., 1950 RPM with field rheostat for frequencies up to 400 cyc., 3 ph. Price $80.00

HOLTZER-CABOT MG UNIT. Motor: 120 VDC, 5 amp., 2500 RPM. Output: 75 VAC, 9 amp., 500 cyc. 675 VA. 1 ph. Price $49.00

BRITISH ALTERATORS. 1.5 KVA., 230 Volts, 1ϕ, 400 CPS. sep. exc. Price $115.00

ONAN 400 CYCLE MG SET. Motor: 5 HP, 220/3/60. Generator: 2 KW, 115 volts, single phase, 400 CPS, self excited with secondary output of 28 volts DC, 200 watts. V-belt drive. Price $435.00

ONAN 400 CYCLE MG SET. Motor: 7½ H.P. operative at 220/440 V 3ϕ, 60 cy. V belted to self-excited alternator with output of 4 KVA. 115 Volts, single ph. 400 C.P.S. Alternator is self-excited with secondary output of 14 VDC 60 Amp. With Voltage Regulator built-in. Price $712.00

G.E. MG SET MODEL 5LY56AB5A. Motor: 1.1 HP. 250 VDC, 4 amp. Generator: 600 watts, 125 VAC, 4.8 amp., 500 cyc., 1 ph. Price $89.50

GENERAL ELECTRIC 400 CYCLE UNITS. Operate at 28 VDC 100 Amp. Output: 115 VAC 1ϕ, 400 CPS, 1500 V.A. With filter system built-in. Price.....$29.50

MARCONI MG UNITS. Operative at 110 VDC to deliver 200 VAC, 6 amp. 2 KW. 240 cycles. Extending shaft permits driving complete unit to obtain dual self-excited generator. Price $89.00

CROCKER-WHEELER 500 CYCLE MG SET. Compact 2 bearing Unit. Operative at 120 VDC, 7.8 amps. Output: 250 Volts, 5 amp., 500 cycles. Rebuilt. Price $88.85

WESTINGHOUSE AMPLIDYNE TYPE MG SETS

Motor: Type CS, Fr. 204, 200 v, 3 ph., 60 cyc., 4 amps. 1.5 HP, directly connected to 2 DC gen. (1) 185 VDC, 2.5 amp., .35 KW. Gen. (2) 250 VDC, 2 amp., srp. exc. 35 volts. The 2 units are contained in one housing. Brand new. The generators have similar characteristic of an amplidyne with a set of control fields and are completely enclosed with rubber gaskets on the enclosing covers, which can be removed for increased KW output. $125.00 ceptional value at.....$183.60

GEN. ELECTRIC AMPLIDYNES

Model 5AM73AB69: Input: 115 VAC, 1ϕ, 60 cycle. 9 amp. Output: 375 K.W. 250 VDC, 1.5 amp.....$85.00

Model 5AM65FB2A; Input: 115 VAC, 3ϕ, 60 cyc. 5 amp. Output: 500 volts, 2 Amps.....$144.00

Model 5AM49AB30: Input: 440 Volts, 3 phase, 60 cyc. 1 amp. output: 115 Volts, D.C. 2.35 amp. 3450 RPM. Price $98.50

Model 5AM31NJ18A; Input: 27 VDC, 44 amp. 3200 RPM. Output: 60 VDC, 8.8 amp. 530 watts.....$12.95

Model 5AM78AB19: Input: 33 VDC, 60 amp. 2 H.P. 3200 RPM. Output: 250 Volts, D.C. 3 amperes; 750 Watts $190.00

Model 5AM45DB26; Input: 440 V. 3ϕ. 60 cyc. Output: 125 V.D.C. 1.0 Amp.....$85.00

Model 5AM49AB7A; Input: 440 Volts, 3ϕ, 60 Cyc. Output: 375 Watts, 250 V.D.C. 1.5 Amp. Price $165.00

Model 5AM45DB8, DB15, DB30. Input: 440V, 3ϕ, 60 cyc. Output: 250 VDC, .6 amp.....PRICE $85.00

Model 5AM78AB47: Input: 440V. 3ϕ. 60 cyc. Output: 250 VDC, 3 amp. With control generator direct connected on common base rated .75 KW. 60 VDC, 12.5 amp. .....PRICE $285.00

Model 5AM78AB90A or 7B: Input: 440V, 3ϕ, 60 cyc. Output: 250 VDC, 6 amp.....PRICE $285.00

Model 5AM78AB16: Input: 440V. 3ϕ. 60 cyc. Output: 250 VDC, 2.0 amp.....PRICE $185.00

Model 5AM73AB58: Input: 115/230, 1ϕ, 60 cyc. Output: 250 VDC, 1.0 amp.....PRICE $100.00

G.E. Amplidyne Generator Model AM701. 35 KW, 125 amps., 200 volts, 1785 RPM, special duty cycle, 450 volts, 220 amps.....PRICE $975.00

G.E. AMPLIDYNE GENERATOR Model 5AM620A, 440 volts, 33 amps., 1700 RPM.....PRICE $790.00

BOGUE ELECTRIC AC/DC MG SET. Consists of 7.5 HP motor in center directly connected to 2, 18 volt 160 amp. generators. Will deliver 24 volts at 160 amp. or 12 volts at 320 amp. Condition like new. Price $375.00

GENERAL ELECTRIC Type B Flange Motor for hoisting duty. 6¾ H. P. separately excited. Marine Duty. Brand new, original cases; 238 Volts. DC. 1160 RPM. $85.00

WINCHARGER WIND GENERATOR. 12 volts, 250 watts, complete with all fittings including propeller. Excellent for battery charging. Price....(New) $70.00

GARDNER DRY TRANSFORMER. 2.42 KVA. 230/115 to 5.7 volts, 400 cycles. Price $40.75

RAYTHEON VOLTAGE STABILIZER (CONSTANT VOLTAGE TRANSFORMER). Input 190-200 volts. Output 230 volts, 250 VA. Price.....$31.75

RAYTHEON CONSTANT VOLTAGE TRANSFORMER. .5 KVA. Input 189-209 volts. Output 220-230 volts. Price $67.50

ACME AIR-COOLED TRANSFORMER. Primary: 500 volts. Secondary: 14,840 volts with C.T., 3 phase, 60 CPS, 18.2 KVA, brand new. Price.....$390.00

ALLIS-CHALMERS MG UNIT. .94 KVA. Input 24 VDC, 63 amperes. Output 120/60/1, 7.83 amperes, 3600 RPM. New. Price $149.90

50 CYCLE FREQUENCY CHANGER Motor: 15 HP, 220/440/3/60, V-belted to 8 KVA, 220 V, 50 CPS, 4 ph., British made alternator.....PRICE $575.00

LV DC MOTOR GENERATOR SET. Motor: 220/440/3/60, direct connected to DC Fano generator 30 V, 100 amps., 1750 RPM. .....PRICE $348.00

18 KVA GENERAL ELECTRIC TRANSFORMER. 440/220/110 V, 1 phase, 60 cycles, Type H, Form N, oil cooled .....PRICE $102.00

HV MOTOR GENERATOR SET. Motor: 220/440/3/60, V-belted to Crompton generator 500 VDC, 0.5 A. PRICE $495.00

WE CAN SUPPLY MOTOR-GENERATOR SETS TO ANY FREQUENCY SPECIFICATIONS AND FOR ANY APPLICATION.

CONSULT OUR ENGINEERING DEPARTMENT.

IF IT'S FROM ONE FREQUENCY TO ANOTHER; FROM DC TO AC OR AC TO DC, IF IT'S FROM ONE VOLTAGE TO ANOTHER, THEN CALL ON US.

Established in 1922

WILLIAM I HORLICK COMPANY

Tel. HAncock 6-2480

409 ATLANTIC AVE. BOSTON 10, MASSACHUSETTS

25 WATT POTENTIOMETERS

Ohm	Bush	Shaft	Cat #	Price
2	5/8s	1/8sd	O-H	$1.04
3-3	1/2	1/2	I	1.04
15	3/8	1	C	1.04
15	3/8	1-1/8	D-245	1.04
15	1/2	1-1/4	I	1.04
25	1/2	1/2F	D-245	1.04
25	3/8	1	D-245	1.04
30	3/8	1	C	1.04
50	3/8	1-1/8	D-245	1.04
50	5/8	1/8sd	O-H	1.04
75	1/2	7/16	O-H	1.04
100	3/8	1	D-245	1.04
250	3/8	1-1/8	O-H	1.04
500	3/8	11/16	D-245	1.04
1K	1-2	1/2	O-H	1.17
2K	3/8	1-1/16	D-245	1.20
5K	1/2	1/8sd	I	1.24
5K	3/8	7/8F	D-245	1.24
20K	1/2	1/8sd	D-245	1.40

These excellent wirewound controls are manufactured by the leading companies and are in the original cartons. Priced ridiculously low, only 20% of list. SATISFACTION GUAR.

50 & 100 WATT POTENTIOMETERS

Ohm	Watt	Cat. #	Price
75	100	O-K	$2.19
250	50	O-J	1.41
500	50	D	1.41
500	100	O-K	2.19
800	50	O-J	1.41
1.5K	100	O-K	2.34
2.5K	50	O-J	1.41
5K	50	O-J	1.56

COMPUTER POTENTIOMETERS $22.50

Cat.	Resistance Taps	Funct
D170547	20,363 (Ω) 4	Sine-
	13,585 (Ω) 4	Cosine
D170561	26,000 1	Non-L
D170562	4,000 (Ω) 1	Linear
	985 (Ω) 1	Linear

CHOKE. Conservatively rated 165 MA. 5 Henries 100 ohm dc. 2 Inch High. 3 ¾" Mtg. Ctr. Worth $3. SALE PRICE

89 cents

TURRET LUGS

For making mounting boards. Swaging tools for each different style $3.

For various thickness boards add the following:
A—1/32" C—3/32"
B—1/16" D—1/8"

Number Our	Other	Price for 100
1200	x1548	$1.38
1210		1.70
1220	x1143	2.70
1230		3.31
1240		3.95
1250		2.34
1260	X1558	1.32
1280	X1463	1.68
1300	X1724	1.32
1310		2.80
1320	X1579	2.90
1330	X1796	2.02
1340	X1457	1.30
1350	X1345	2.90
1360	1081	1.13
1391	X1578	2.49
2000	X1785	2.20
2010		1.78
2020		3.15
2030		1.95
2040		1.46
2050		1.39
2060	X1694	1.65

RG8/U COAXIAL CABLE, poly. 1200 ft. reels 14¢ per foot. Less at 16¢ per foot.

WIREWOUND POTENTIOMETERS

Ohm	Bush	Shaft	Cat #	Watt	Clean New
10	3/8	1-5/8	I	2	
15	3/8	2	C	2	
20	1/2s	1/8sd	CTS	2	
20	1/8	1/8	M	4	
30	1/8	1-1/4	CTS	4	
50	1/8	3/8sd	M	4	
100	5/8	1/8F	I	2	
100	1/8	5/16	CTS	4	
200	1/8	7/8	CTS	4	
200	5/8s	1/8sd	CTS	4	
200	1/8	2-1/16	CTS	4	
250	1/2s	1/8sd	CTS	2	
250	1/8	1-1/4	I	2	
250	1/8	1/2	CTS	4	
400	1/8	1-1/8sd	CTS	4	
500	1/8	1/8sd	CTS	4	
1K	1/8	1/8	I	2	
1K	1/8	1/8	CTS	4	
1K	1/8	1/8sd	CTS	4	
2K	1/4	1/8	CTS	2	
2K	1/2s	5/16sd	CTS	4	
2K	1/8	1-1/16	CTS	4	
2K	1/2	1-1/2	TRF	4	
3K	1/8	1/2	CTS	4	
3K	1/8	1-1/2F	C	4	
5K	1/8	7/16sd	CTS	2	
5K	1/2	1/2sd	TRF	4	
5K	1/2	1-7/8	TRF	4	
5K	7/16	1-7/16	C	4	
7.5K	1/2	1/8	CTS	4	
10K	1/8	1/2sd	CTS	2	
10K	1/8	3/8F	I	2	
15K	1/8	1/2sd	CTS	4	
20K	5/8	3-1/16	CTS	4	
20K	5/8	1/8	CTS	4	

ONLY 45¢ EA.

PRECISION WW POTS.

Ohm	Cat #	Price
10	D-292	$1.20
12	361AS	1.20
1K	314	2.25
1.5K	D-291	2.25
2K	D-290	2.25
5K	314	2.25
10K	D	2.25
20K	D-290	1.70
50K	314	3.50

RELAYS

Coil	Cont.	Cat. No. Description	Price
6 dc	dpdt	SK5032 sealed	$3.95
16dc	dpdt	2Z7717.8, 60 ohm	1.50
12vdc	dpst & spdt	micalex board 2023 MXF	1.50
21vdc	dpdt	small 300 ohm	.95
24vdc	spst	contacts only touch ceramic on relay good for high impedance circuit	.90
24vdc	spst	small relay, big contact 3 amp. 24VDC INDUCTIVE	.95
24vdc	dpdt	BJ2SOP	1.85
24vdc	dpdt	BJ440P	1.55
24vdc	dpdt	3 amp contact very neat single stud mtg.	.80
28vdc	dpdt	POs B SD 10XBX102, 7 amp	1.75 .90
25vdc	dpst	Ceramic 1074	.95
24vdc	spst	200 amp contactor	8.90
1000 ohm, 22.5 vdc telephone type	dpst	each double point	.95
1200 O spdt		10MA tiny]	.95
1500 O dpdt		25MA Advance 1049]	[1.50
13500 Ohm	dpdt	& 2NC, 3MA	2.75
24vac	dpdt	Allied BJ	1.85
115ac	4pos	Leach 2124 SMX	3.50
Ledex Stepping 6 position	8pole		5.95
115ac time delay relay adjustable 1-1/2-58 minutes clock mtr			6.95

Widely Known for Fair Dealing and Good Service

HAROLD H. POWELL

2104 MARKET STREET
PHILADELPHIA 3, PENNA.
PHONE LOcust 7-5285

OIL FILLED CAPACITORS

Mfd.	Volt	Size	Price
.02	600	BT 1 x 1-3/4 x 3/4 CD side	$.95
.1	3000ac	5/8" dia. w mtg strap tnh	.45
.1	400	tubular w strap type NHJ	.39
.1	640	BT side 1 x 1-3/4 x 3/4 Asvo	.95
.1	T600	POil 1/4" dia x 5" high, bkt.	4.95
.1-.1	400	BT top 1-3/4 x 7/8 x 3/4 CD	.69
.1-.1	640	BT side Foot	.75
.25	600	1 5/8 x 1 1/4 x 5/8 invert mtg.	.95
.25	600	BT bottom lug asvo	.95
.25	600	OM625 with bkt	.95
.25	600	BT top terminal	.95
.5	400	BT top terminal cd	.69
.5	600	2 x 3/4 x 1 1/4 upright mtg	.95
.5	400	BT CP50B1DE506KK	.95
.5-.5	400	2 1/2 x 1 1/4 x 5/8 inverted asvo	1.69
1	500	23F297 invert channel	.95
1	500	23F206 upright channel	.95
1	600	CP64B1EF105V	.95
1	600	BT lugs on opposite ends edge mtg. 1-3/4 x 1-1/2 x 7/8	.98
1	600	OM601 w bkt up or down	.95
1-1	600	side term type 630 Bathtub	2.45
2	600	1-3/16" sq x 2-3/8 high top terminal	1.39
2	600	BT side term 2 x 2 x 1-1/8 cd	1.79
2	600	OMT TORK	1.79
2	600	1-3/8" rd x 3-3/8" high 6105f	1.79
3	1000	TJ10020 in ctn	2.45
5-5	400	Oilmite RAL300 invert	.75
6-8	600	Filtermite 2-3/4" sq 3-3/4" high	4.95
10	220vac	equal to 600vdc 2 1/2" rd 3-7/8"	1.65
20	220vac	1-3/4 x 3 3/4 x 4 3/4	3.95

TURRET SOCKETS

SAVE TIME BETTER CIRCUIT

Socket	Height	Stock #	Price
Octal	2 1/2"	18-9-9T	$.59
Octal	2"	8-6-9T	.57
Octal	1 1/2	6-8-9T	.54
Min.	2"	12-MB-12	.72
Min.	2"	8-M-9T	.63
Min.	1 1/2	6-M-6T	.60
Min.	1"	4-M-6T	.59
Noval	2"	2-NB-12	.72
Noval	2"	8-N-9T	.66
Noval	1 1/2	6-N-6T	.65
Noval	1"	4-N-6T	.63

DO'S Speed Delivery

COAXIAL CONNECTORS

Type	Price
UG9/U	$1.20
UG19/U	1.20
UG12/U	1.20
UG13/U	1.20
UG18B/U	1.95
UG21/U	1.20
UG22/U	1.50
UG23/U	1.50
UG24/U	1.30
UG25/U	1.25
UG27/U	1.30
UG29/U	2.15
UG30/U	2.50
UG58/U	.80
UG85/U	2.25
UG87/U	1.50
UG88/U	1.50
UG97/U	4.00
UG97A/U	4.20
UG98/U	2.25
UG104/U	1.80
UG105/U	1.80
UG106/U	.10
UG107/U	1.50
UG131/U	4.50
UG167/U	2.00
UG173/U	.43
UG178/U	.17
UG176/U	.17
J-201	4.50
UG203/U	.85
UG224/U	1.45
SO-239	.40
SO239 Y	.60
UG245/U	2.90
UG255/U	2.25
PL258	.95
PL259A	.55
PL259	.50
UG260/U	1.50
UG282/U	1.50
UG274/U	4.50
PL274	1.35
UG275/U	4.50
UG290/U	1.80
UG296/U	3.75
UG306/U	3.50
UG335/U	2.75
UG342/U	2.25
M359	.35
48547	1.20
UG422/U	3.25

HIGH VOLTAGE GLASS METAL SEAL

10¢ each. $7.50 per 100. $65 per 1000

SELENIUM RECTIFIERS

VDC	VAC	AMP	Price
10	13	2	$3.00
18	13	22	18.10
20	26	6	8.00
40	52	2	18.10
40	52	12	18.05
40	52	22	34.30
100	130	.5	9.85
120	156	2	23.50
130AC		15MA	.62
130AC		100MA	.98
130AC		250MA	1.48

PULSE FORMING

DELAY LINE 15-F4-91-400-50P, Sprague # 98G-7245. H623, 4x5x7 inch oil filled with 3½ inch insulators. 0.91 Microsecond, 15KV **$9.90**

TINY 10 AMPERE FILTER

60 db. att. .15 to 30 Mcs. Permalloy core. D170738 ..... **$3.90**

PULSE TRANSFORMERS

UTAH 9287D

Windings: three O.C. res: 4.2, 4.4, 4.8. L: tot. pri. 3.2 mh true pri. 1.6 mh leakage 17 micro H Dist. capacitance between windings: 80. Ze: 430 ohms. Turns: 100. Core: 16 strips .002" hypersil wound in three turns. Optimum pulse width: 0.9 microseconds. Sharpest pulse: (B.C.) 0.25 microseconds.

Write for prices, giving exact quantity required

901756-501. RCA, 15/16 dia. x 1⅝" high, 165 turns on primary, 330 turns secondary, core is ¼" stack of .007 inch "P" laminations. Magnetic Metals Co. Audio 58, used to form 7.3 microsecond pulses $1.50

901756-502. RCA, same core & can as 501, 100 to 200 turns, used to form 2.2 microsecond pulses $1.50

A117012. Bendix, 1 ⅝ x 1 7/16 x 1 15/16" can, nine terminals. Hypersil core $1.50

C12A-1318. Jefferson, 50 millihenry & 10 millihenry, 2⅝ x 3 x 3¼ $1.95

D161310. WE frequency response 50Kc to 4 Mc. Video input, 120 to 2350 ohm. Perm. core. ..$2.50

K2468B. GE Magnetron pulsing Mdlar $18.00

250KVA peak power at ¼ microsecond pulse, 1000/1" duty cycle, 385KV into 50 ohm pulse cable socket gives 17.3 KV to built-in Mag. socket. Cost $223, SALE PRICE $7.50

UTAH 9289 ..... $7.50

RAYTHEON UX7307 ..... $7.50

TOGGLE SWITCHES

Molded Bakelite — 7/16" Bushing
N.P. Nut Handle

Contact	Current	Stock #	Price
SPST	6A	1159	$.35
SPDT	3A	112	.44
DPDT	3A	114	.66
DPDT	Center off		.66
	1A	138	.68

AN CABLE CLAMP

AN No.	FITS SHELL	NET
3057-3	8S, 10S-L	$.36
3057-4	12, 12S	.36
3057-6	14, 14S	.36
3057-8	16, 16S	.42
3057-10	18	.42
3057-12	20, 22	.42
3057-16	24, 28	.48
3057-20	32	.96
3057-24	36	.96
3057-28	40	1.06

AN CAPS

9760-8	$ .50
9760-10	.50
9760-10P	.50
9760-12	.50
9760-14G	.50
9760-14	.50
9760-16	.50
9760-18	.55
9760-18G	.55
9760-20	.55
9760-22	.60
9760-22G	.60
9760-28	.65

3057 AN CONNECTORS

COMPLETE NEXT PAGE →

VITAMIN Q TUBULAR CONDENSERS

Cat. No.	Mfd.	Volt	Qu.	Price
774-6064.*	.0033	600	231	$.95
G191P10391	.01	100	60	1.50
G91P10392	.01	200	250	1.49
G88P10394	.01	400	180	1.65
G191P22391	.022	100	20	1.65
G191P68352	.068	200	454	1.65
G91P82594	.082	400	45	1.65
G91P15491T	.15	100	199	1.65
G191P22491	.22	100	49	1.65
G191P27491	.27	100	23	1.65
G191P4791	.47	100	140	1.75
G91P56492	.56	200	28	1.75
G91P68492	.68	200	30	2.10
G91P10592	1	200	70	2.20
XFC 1846 *	1	600	20	2.20

* not Vitamin Q but similar

THESE ULTRA HIGH QUALITY CONDENSERS ARE MADE BY LEADING MANUFACTURERS. Feature

- **20,000 Megohm or More**
- **Subminiature**
- **Glass Seal Terminals**
- **Up to $7.70 regular**

26 CONDUCTOR CABLE made up by Western Electric in 50 foot lengths with 8324CCT connectors on each end. Each conductor is #22 standard and rubber covered. Although the O.D. is only 9/16 inches there is a heavy live rubber jacket.
Per length, only $9.95

POWER SUPPLY, PE204A, Radiart to operate from 12 volts DC to supply plate & screen & DC filament volts to telephone repeater EE99 & TY14. Sealed in original packing cases with spare vibrator, cable, schematic, etc. Approx. 50 MA $5.95

CONVERTER, Electronic Labs Model 1485, 28 VDC input, 115 volts, 60 cy., 50 watts output, complete with NSB 1341 vibrator $9.95

AN CONNECTORS

Number	Description	Price
MS3102A-10SL-3P	Box mounting receptacle	$1.95
MS3106A-10SL-3S	Cable connector	1.95
MS3102A-14S-2P	Box mounting receptacle	1.95
MS3106A-14S-2S	Cable connector	1.95
MS3102A-18-1P	Box mounting receptacle	1.95
MS3106A-18-1S	Cable connector	1.95
MS3102A-20-4P	Box mounting receptacle	1.95
MS3106A-20-4S	Cable connector	1.95
MS3102A-22-22P	Box mounting receptacle	1.95
MS3106A-22-22S	Cable connector	1.95
MS3102A-24-28P	Box mounting receptacle	1.95
MS3106A-24-28S	Cable connector	1.95
MS3102A-28-21P	Box mounting receptacle	1.95
MS3106A-28-21S	Cable connector	1.95

NOTE: PRICES ON THIS PAGE ARE NET

AN CONNECTORS—DISCOUNT: 50% PHENOLIC, 40% MELAMINE

Insert	Shell and 1947 List Price 3100	3101	3102	3106	3108
8S-1S	$1.89	1.63	1.19	1.59	2.61
8S-1P	1.53	1.89	1.19	1.89	2.67
10SL-2S	1.48	1.52	1.08	1.39	2.47
10S-2P	1.43	1.48	1.08	1.46	2.55
10SL-3S				1.73	2.67
10SL-3P	1.73	1.77	1.42		
10SL-4S				1.53	2.76
10SL-4P	1.89	1.63	1.19		
10S-4S&S	1.48	1.53	1.08	1.89	2.81
10S-4S&P	1.43	1.41	1.04	1.53	2.72
12S-3S	1.63	1.73	1.19	1.97	2.72
12S-3P	1.68	1.68	1.24	1.97	2.87
12S-4S	1.89	1.83	1.04	1.89	2.72
12S-4P	1.89	1.53	1.04	1.89	2.72
12-5S	1.89	1.92	1.39	1.97	3.01
12-5P	1.53	1.73	1.24	1.92	2.81
12S-6S	2.37	2.37	1.84	2.67	3.73
12S-6P	3.14	3.49	2.61	3.179	4.56
12SL-6&4S	NA	NA	NA	2.60	3.94
12SL-6-844P	2.50	2.65	1.95	NA	NA
14S-1S	1.77	2.03	1.33	2.37	3.16
14S-1P	1.77	2.03	1.33	2.52	3.16
14S-2S	1.88	1.97	1.43	2.41	3.25
14S-2P	2.06	2.17	1.63	2.37	3.50
14-3S	2.03	2.03	1.43	2.17	4.15
14-3P	2.03	2.03	1.43	2.17	3.01
14S-4S	1.70	1.79	1.43	2.27	3.16
14S-4P	1.39	1.48	1.08	1.97	2.81
14S-5S	2.12	2.37	1.57	2.47	3.71
14S-5P	2.12	2.37	1.59	2.47	3.71
14S-6S	2.87	2.87	2.17	2.87	4.39
14S-6P	2.61	2.61	2.08	2.96	4.09
14S-7S	2.87	2.87	2.17	2.87	4.39
14S-7P	1.97	1.97	1.45	2.37	3.16
14S-9S	2.08	2.08	1.53	2.37	3.84
14S-9P	1.77	2.03	1.33	2.37	3.16
14S-11S	2.17	2.17	1.63	2.52	3.45
14S-11P	2.37	2.37	1.83	2.72	3.85
14S-12S	2.08	2.08	1.53	2.37	3.56
14S-12P					
16S-1S	2.61	2.87	2.23	3.21	3.85
16S-1P	2.87	2.87	1.88	3.21	4.40
16-2S	2.27	2.52	1.84	2.72	3.96
16-2P	2.08	2.12	1.48	2.47	3.56
16S-3S	1.83	1.92	1.24	2.23	3.41
16S-3P	1.83	1.92	1.24	2.23	3.41
16S-4S	1.92	2.03	1.39	2.37	2.92
16S-4P	1.92	2.03	1.39	2.32	3.56
16S-5S	2.17	2.37	1.73	2.76	3.96
16S-5P	2.17	2.37	1.73	2.67	3.76
16S-6S	2.17	2.37	1.83	2.67	3.91
16S-6P	2.12	2.17	1.63	2.52	3.71
16-7S	2.47	2.47	1.88	2.87	4.39
16-7P	2.27	2.52	2.32	2.81	3.91
16S-8S	2.37	2.72	2.08	2.97	3.45
16S-8P	2.01	2.12	1.53	2.47	3.56
16-9S	2.72	2.87	2.12	3.25	4.29
16-9P	2.57	2.67	2.03	3.01	4.05
16-10S	2.61	2.76	2.12	3.11	4.00
16-10P	2.37	2.52	1.83	2.72	3.85
16-11S	2.37	2.52	1.83	2.47	3.91
16-11P	2.37	2.87	1.59	2.72	3.80
16-12S	2.67	2.72	2.03	2.97	4.05
16-12P	2.37	2.47	1.77	2.76	3.85
16-13S	2.96	2.92	2.19	3.02	4.74
16-13P	2.21	2.37	1.50	2.67	3.56
16S-15S	2.08	2.08	1.43	2.37	3.00
16S-15P					
18S-1S	3.45	3.80	2.87	3.91	5.19
18-1P	3.00	3.45	2.16	3.40	4.72
18-2S	2.81	3.16	2.08	3.21	4.49
18-2P	2.61	2.72	1.63	3.80	4.25
18-3S	2.76	2.96	2.08	3.11	4.25
18-3P	2.72	2.72	1.45	2.96	4.25
18-4S	2.87	2.92	1.83	3.11	3.95
18-4P	2.67	2.87	1.83	3.11	4.25
18-5S	2.76	2.76	1.83	3.16	4.44
18-5P	2.96	2.67	1.68	2.96	4.44
18-6S	2.87	2.92	1.83	3.01	4.00
18-6P	2.72	2.72	1.83	3.01	4.00
18-7S	3.36	3.11	2.03	3.40	4.44
18-7P	2.87	2.68	2.05	3.16	4.55
18-8S	2.71	2.71	2.03	3.16	4.44
18-8P	3.80	3.65	2.61	3.71	4.93
18-9S	4.00	3.84	3.41	4.09	4.40
18-9P	4.00	3.20	2.92	4.35	5.19
18-10S	3.96	3.71	2.97	3.84	5.24
18-10P	3.56	3.25	2.17	3.41	4.75
18-11S	3.60	3.36	2.47	4.35	5.39
18-11P	3.21	3.25	2.32	3.84	4.93
18-12S	3.11	3.24	2.52	3.36	4.64
18-12P	3.71	3.16	2.23	3.35	4.99
18-13S	4.04	4.00	3.41	3.84	5.24
18-13P	3.45	3.16	2.23	3.95	4.84
18-14S	3.85	3.60	2.52	4.99	5.99
18-14P	3.36	3.16	2.52	4.35	5.39
18-15S	3.96	3.71	2.96	5.33	6.99
18-15P	7.94	7.56	6.34	8.90	9.36
18-16S	3.07	2.97	1.73	3.24	4.38
18-16P	2.87	2.87	2.01	3.21	4.39
18-17S	4.09	3.71	2.41	4.49	5.28
18-17P	4.09	4.09	2.01	4.35	5.59
18-18S	2.91	2.91	2.03	3.16	4.44
18-18P	4.09	3.09	2.01	4.35	5.59
18-19S	15.99	15.25	13.80	15.75	16.39
18-19P	7.00	7.00	6.30	7.10	8.80
18-20S	2.96	3.11	2.08	3.21	4.49
18-20P	3.21	2.92	2.12	3.76	4.99
18-22S	3.51	3.16	2.08	3.71	4.99
18-22P	2.61	2.72	1.63	3.80	4.25
18-24S	3.09	3.09	2.17	4.40	4.79
18-24P	3.80	3.45	2.37	4.50	4.99
18-30S	2.96	3.11	2.08	3.21	4.49

Insert	Shell and 1947 List Price 3100	3101	3102	3106	3108
18-30P	3.31	2.92	2.12	3.76	4.99
18-31S	2.96	3.11	2.08	3.21	4.49
18-31P	3.31	2.92	2.12	3.76	4.99
18-404S	7.28	7.28	5.85	7.98	10.14
18-404P	4.55	4.95	3.65	6.55	6.75
20-1S	4.44	4.69	3.60	4.75	6.04
20-1P	5.63	6.32	3.91	6.92	6.97
20-2S	3.25	3.36	1.92	4.05	4.25
20-2P	3.11	3.31	1.83	3.45	4.20
20-3S	3.71	3.76	2.23	4.25	4.69
20-3P	3.41	3.56	1.97	3.80	4.84
20-4S	3.36	3.36	2.08	3.76	4.93
20-4P	5.16	3.20	1.92	3.71	4.84
20-5S	3.97	3.16	2.08	3.45	4.40
20-5P	2.87	2.92	1.45	3.56	4.20
20-6S	3.25	3.45	2.08	3.40	4.49
20-6P	3.25	3.31	1.83	3.60	4.05
20-7S	3.81	4.15	2.87	4.30	5.04
20-7P	4.35	4.69	3.25	4.64	5.59
20-8S	4.40	4.44	3.01	3.35	5.33
20-8P	4.20	4.20	2.81	3.89	5.09
20-9S	4.29	4.40	2.92	4.79	5.28
20-9P	4.15	4.20	2.76	4.64	5.05
20-10S	3.36	3.36	2.08	3.76	4.93
20-10P	3.16	3.20	1.92	3.71	4.84
20-11S	4.64	4.76	4.02	3.49	7.77
20-11P	3.57	3.60	2.93	4.39	6.72
20-12S	3.56	3.56	2.17	4.44	4.49
20-12P	3.36	3.45	2.03	3.80	4.35
20-13S	3.65	4.75	2.27	4.84	4.89
20-13P	3.11	3.20	2.05	3.80	4.55
20-14S	4.40	4.44	3.11	5.39	5.39
20-14P	3.91	4.44	2.92	4.16	5.28
20-15S	4.49	4.49	3.41	4.89	5.43
20-15P	4.25	4.09	2.61	4.89	4.93
20-16S	4.55	4.79	3.31	4.89	5.63
20-16P	4.44	4.49	3.11	4.83	5.43
20-17S	4.44	4.44	3.11	4.83	5.43
20-17P	4.20	4.29	2.81	4.59	5.19
20-18S	4.84	4.93	3.41	5.83	5.83
20-18P	4.25	4.29	2.81	4.59	5.24
20-19S	4.29	4.25	2.81	5.39	5.19
20-19P	3.91	4.15	2.72	4.21	5.04
20-20S	4.25	4.29	2.81	4.49	5.24
20-20P	3.80	3.91	2.41	4.40	4.79
20-21S	4.59	4.75	3.28	4.93	5.63
20-21P	4.44	4.44	3.11	5.43	5.43
20-22S	4.44	4.44	3.11	4.83	5.43
20-22P	4.25	4.35	2.87	4.55	5.24
20-23S	3.71	3.88	2.32	4.84	4.69
20-23P	3.71	3.80	2.32	4.80	4.55
20-24S	3.91	4.00	2.97	5.04	4.89
20-24P	3.71	3.80	2.32	4.35	4.69
20-28S	4.44	4.84	3.40	4.73	5.83
20-28P	5.03	6.03	4.59	5.92	6.92
20-28S	3.85	3.91	2.47	5.04	4.84
20-28P	3.45	3.71	2.23	3.80	4.55
20-29S	4.65	4.80	3.15	4.80	5.25
20-29P	3.40	3.85	2.55	3.45	4.60
20-28S	4.44	5.04	3.40	4.73	5.83
20-28P	5.03	6.03	4.59	5.92	6.92
20-29S	7.07	6.83	5.93	7.82	9.41
20-29P	4.52	4.07	3.37	5.30	6.85
22-1S	3.71	3.71	2.03	4.25	5.84
22-1P	3.41	3.45	1.88	4.00	4.79
22-2S	4.29	4.35	2.87	5.24	5.43
22-2P	3.95	4.00	2.57	4.40	5.33
22-3S	3.71	3.76	2.32	4.79	4.84
22-3P	3.36	3.36	1.97	3.95	4.75
22-4S	4.00	4.09	2.52	4.55	4.89
22-4P	3.71	3.91	2.37	4.00	4.79
22-5S	3.95	3.95	2.57	4.15	5.23
22-5P	3.71	3.71	2.37	3.91	5.09
22-6S	3.71	3.71	2.27	4.75	4.84
22-6P	3.56	3.56	2.12	4.29	4.56
22-7S	3.85	3.85	2.47	4.75	5.24
22-7P	3.41	3.41	2.03	4.00	4.79
22-8S	3.71	3.91	2.52	4.15	5.24
22-8P	2.96	3.11	1.68	3.41	4.44
22-9S	3.71	3.76	2.27	4.75	5.04
22-9P	3.21	3.25	1.92	4.00	4.15
22-10S	3.16	3.76	2.17	3.84	4.84
22-10P	3.41	3.45	2.03	3.91	4.79
22-11S	3.85	3.96	2.42	4.69	4.84
22-11P	3.87	3.96	1.97	3.25	4.49
22-12S	4.29	4.29	2.76	4.79	5.53
22-12P	3.85	3.91	2.47	4.59	5.24
22-13S	4.29	4.29	2.87	5.83	5.63
22-13P	3.60	4.00	2.57	4.05	5.28
22-14S	5.19	5.97	4.64	5.89	6.81
22-14P	4.79	5.91	3.97	4.06	7.21
22-15S	5.19	5.24	3.76	4.37	6.52
22-15P	3.95	4.09	2.67	4.35	5.39
22-16S	3.93	3.79	2.51	4.88	5.23
22-16P	4.35	4.40	3.01	5.59	5.73
22-17S	4.25	4.79	3.31	4.64	5.88
22-17P	4.44	4.49	3.07	4.83	5.63
22-18S	4.44	4.49	3.07	4.83	5.63
22-18P	3.91	3.91	2.52	5.09	5.58
22-19S	4.49	5.24	4.08	4.89	6.17
22-19P	3.80	3.93	3.45	5.07	4.99
22-20S	3.85	4.44	3.07	4.25	5.48
22-20P	4.09	4.15	2.67	4.53	5.19
22-21S	4.05	4.79	3.56	5.04	5.68
22-21P	4.09	4.20	2.72	4.55	5.68
22-22S	4.18	4.48	2.92	5.24	5.68
22-22P	4.20	4.20	2.76	4.79	5.83
22-23S	4.40	4.40	3.01	5.33	5.77
22-23P	4.40	4.40	3.01	5.33	5.77
22-24S	4.18	4.99	2.72	4.20	5.48
22-24P	4.18	4.99	2.72	4.20	5.48
22-25S	4.18	4.99	2.72	4.20	5.48
22-25P	4.18	4.20	2.72	5.24	5.48
22-26S	3.80	3.80	2.37	4.40	5.19
22-26P	4.49	4.49	3.11	4.79	5.83

Insert	Shell and 1947 List Price 3100	3101	3102	3106	3108
22-26P	4.20	4.25	2.81	4.75	5.83
22-27S	4.89	5.09	3.71	5.33	6.43
22-27P	4.29	4.84	3.31	4.75	5.93
22-28S	4.55	4.95	3.16	5.77	6.92
22-28P	3.80	3.85	2.37	4.98	5.19
22-29S	4.79	4.84	3.41	5.39	6.12
22-29P	4.49	4.95	3.11	5.43	5.83
22-33S	3.95	4.20	3.11	4.40	5.77
22-33P	4.20	4.25	2.81	5.13	5.53
22-34S	4.15	4.20	2.72	4.89	5.48
22-34P	3.80	3.85	2.62	4.20	5.28
22-36S	7.07	7.54	4.67	8.94	8.48
22-36P	13.00	13.48	12.89	13.96	14.41
22-404S	18.80	18.98	17.98	20.35	20.68
22-404P	11.70	11.85	10.25	11.00	16.10
24-1S	4.44	4.85	2.67	5.28	5.89
24-1P	3.71	4.00	2.57	4.55	5.48
24-2S	4.89	4.79	2.97	5.43	5.97
24-2P	4.09	4.29	2.57	4.49	5.48
24-3S	4.24	4.89	3.01	5.84	5.89
24-3P	3.80	3.80	2.61	4.49	5.53
24-4S	4.64	4.79	2.97	5.43	5.97
24-4P	4.05	4.25	2.67	4.84	5.48
24-5S	4.69	5.04	3.40	5.39	6.97
24-5P	5.19	5.53	3.91	5.13	6.36
24-6S	5.97	4.99	3.31	5.84	6.17
24-6P	5.48	6.37	4.69	6.23	7.45
24-7S	5.28	6.03	3.76	6.03	7.21
24-7P	4.93	5.34	4.06	5.77	6.92
24-8S	4.64	5.24	3.66	5.77	6.92
24-8P	5.53	5.48	3.76	6.37	6.84
24-9S	5.43	5.38	3.85	6.27	6.57
24-9P	4.79	5.28	3.56	5.58	6.47
24-10S	5.04	5.53	4.75	5.77	7.01
24-10P	4.64	4.79	3.27	5.43	5.97
24-11P	4.89	5.28	3.56	5.58	6.47
24-12S	5.04	5.53	4.75	5.77	7.01
24-12P	4.64	4.79	3.27	5.43	5.97
24-14S	4.99	4.93	3.21	5.83	6.12
24-14P	4.00	4.25	2.72	4.79	5.63
24-15S	4.69	5.43	4.40	5.39	6.57
24-15P	4.97	5.43	3.96	6.57	6.92
24-16S	5.28	5.19	3.45	4.69	5.92
24-16P	4.20	4.56	2.81	4.20	5.04
24-17S	5.73	5.43	3.16	5.66	6.56
24-17P	3.80	4.05	2.82	4.59	5.43
24-18S	4.49	4.44	2.72	5.33	5.43
24-18P	4.25	4.25	2.72	4.20	5.13
24-19S	5.59	5.53	3.89	5.48	6.77
24-19P	4.55	5.04	3.31	5.33	6.27
24-20S	5.63	5.63	3.89	5.48	6.77
24-20P	4.84	4.84	3.46	5.68	5.73
24-21S	4.84	4.84	3.46	5.68	5.73
24-21P	4.59	4.55	3.11	5.04	6.37
24-22S	4.79	4.84	3.41	5.39	6.47
24-22P	5.60	5.65	7.45	5.80	10.53
24-23S	5.96	5.93	4.22	6.81	7.97
24-23P	5.15	5.11	3.66	6.00	6.18
24-24S	4.69	5.43	4.40	5.39	6.47
24-24P	6.23	5.63	3.95	6.87	6.92
24-27S	4.44	4.44	2.76	5.84	5.38
24-27P	4.79	4.41	3.27	5.22	5.53
24-28S	7.39	7.25	5.43	8.09	8.28
24-28P	9.28	9.18	7.56	9.48	10.22
24-691S	8.28	8.18	6.74	8.38	9.12
24-691P	4.20	4.56	2.81	4.20	5.04
24-838S	9.09	9.04	7.23	9.83	10.23
24-838P	6.04	6.04	5.35	7.58	8.28
24-846S	4.40	4.60	5.09	5.39	5.59
24-846P	4.00	4.17	2.56	5.80	6.10
28-1S	5.75	6.47	4.57	7.46	7.46
28-1P	5.13	5.53	3.56	5.58	6.76
28-2S	5.89	6.43	4.69	6.17	7.68
28-2P	5.24	5.58	3.56	5.58	7.18
28-3S	5.53	5.97	3.97	6.47	6.97
28-3P	4.35	4.84	2.52	5.39	6.03
28-4S	5.09	5.84	3.66	5.84	6.72
28-4P	4.84	5.24	3.46	5.68	6.68
28-5S	5.84	6.47	4.64	6.47	7.46
28-5P	4.59	5.13	2.92	5.58	6.52
28-6S	6.01	6.63	4.74	6.96	7.46
28-6P	5.04	5.43	3.07	5.43	6.57
28-7S	5.33	5.33	3.61	6.17	6.97
28-7P	4.38	4.49	2.57	5.24	6.12
28-8S	5.48	6.32	4.59	6.27	7.46
28-8P	5.13	5.58	3.65	6.08	7.21
28-9S	6.32	7.25	5.43	7.21	8.84
28-9P	5.38	5.97	3.71	6.27	6.84
28-10S	4.47	6.47	4.29	7.41	7.74
28-10P	5.97	6.08	3.80	6.96	7.32
28-11S	7.41	8.09	5.43	6.74	9.33
28-11P	5.97	7.21	4.93	7.06	8.49
28-12S	6.52	7.58	5.72	7.45	8.84
28-12P	7.10	7.76	6.47	7.56	8.84
28-13S	6.52	7.58	5.72	7.45	8.84
28-13P	7.90	7.80	5.45	8.69	9.09
28-14S	5.94	5.24	4.35	6.67	7.68
28-14P	5.84	6.47	4.64	6.47	7.46
28-15S	5.84	6.78	7.16	9.53	10.74
28-15P	9.28	9.28	7.01	10.23	10.61
28-16S	5.84	6.47	4.64	6.47	7.46
28-16P	5.84	6.56	6.23	7.76	8.09
28-17S	5.89	5.83	4.44	5.97	7.41
28-17P	6.43	6.17	3.91	6.17	6.97
28-18S	6.43	6.17	3.91	6.17	6.97
28-18P	5.89	5.83	3.71	6.57	7.21
28-19S	5.33	6.13	3.85	6.12	7.06
28-19P	4.04	4.30	2.77	5.09	6.01
28-20S	4.32	7.25	4.99	7.16	8.09
28-20P	5.48	6.32	4.00	6.27	7.32
28-21S	10.86	10.86	7.45	11.10	12.14
28-21P	6.52	7.58	7.16	8.89	10.61
28-22S	6.81	6.91	4.49	7.45	8.08
28-22P	6.37	6.97	3.76	6.96	7.56
28-4105	6.56	6.96	6.67	7.41	9.08

Insert	Shell and 1947 List Price 3100	3101	3102	3106	3108
28-410P	6.10	6.48	5.67	6.63	8.30
28-7645	9.90	10.30	7.88	11.25	12.14
28-7646P	7.30	7.70	5.87	8.05	9.18
28-833S	4.30	4.52	2.89	5.07	5.89
28-833P	3.96	4.19	2.66	4.70	5.22
28-840S	8.89	9.30	6.80	9.79	9.44
28-840P	7.30	7.75	5.40	8.30	9.40
28-880S	21.40	21.80	19.40	23.20	23.40
28-880P	22.60	23.00	20.60	24.50	24.84
32-1S	6.47	6.96	4.40	7.98	8.34
32-1P	5.83	6.22	3.91	6.72	7.76
32-2S	7.46	7.96	5.83	8.44	9.42
32-2P	6.96	6.32	3.96	7.05	7.90
32-3S	7.28	7.41	4.93	7.26	8.99
32-3P	6.57	6.81	4.44	7.45	8.31
32-4S	7.30	7.80	4.93	7.98	9.42
32-4P	6.72	7.01	4.64	8.05	8.84
32-5S	6.32	7.28	4.75	7.98	9.38
32-5P	6.32	7.28	4.25	6.47	8.20
32-6S	5.09	5.77	3.56	6.73	7.01
32-6P	10.76	10.96	8.44	11.90	12.40
32-7S	9.33	9.42	7.06	9.83	10.98
32-7P	10.61	10.72	9.79	11.76	12.20
32-8S	9.78	9.82	7.16	9.83	11.41
32-8P	8.98	9.13	5.83	10.12	10.68
32-9S	8.48	8.74	6.41	9.09	10.14
32-9P	7.66	8.08	5.68	8.54	9.09
32-10S	7.98	8.14	5.73	8.69	9.48
32-10P	6.23	6.72	4.49	7.98	8.34
32-11S	8.45	8.74	6.41	9.09	9.38
32-11P	7.83	7.78	6.07	9.36	9.79
32-12S	8.45	8.74	6.41	9.09	9.41
32-12P	7.83	7.41	5.73	9.33	9.41
32-13S	10.74	10.86	9.49	11.73	12.14
32-13P	9.38	9.53	7.10	10.52	11.01
32-17S	12.78	13.30	11.19	13.41	14.43
32-17P	12.48	13.04	10.69	12.82	13.45
32-101S	13.77	15.50	12.76	14.64	15.65
32-101P	11.36	11.50	9.00	12.49	12.99
32-102S	11.84	11.45	9.24	12.44	13.18
32-102P	9.04	9.14	7.10	10.03	10.68
36-1S	8.84	9.28	6.99	9.13	10.94
36-1P	8.20	8.34	5.28	8.84	10.08
36-2S	7.48	8.29	6.12	9.04	9.97
36-2P	7.48	7.98	5.83	8.34	9.28
36-3S	8.44	8.58	6.43	9.77	10.02
36-3P	7.58	7.80	5.83	9.04	9.42
36-4S	7.58	7.80	5.83	9.24	9.73
36-4P	6.72	7.01	4.99	7.80	9.09
36-5S	7.94	8.09	5.92	9.29	9.77
36-5P	6.98	7.10	5.07	8.09	8.44
36-6S	8.84	9.42	7.60	10.78	11.39
36-6P	8.34	8.58	6.37	9.38	10.17
36-7S	12.89	10.94	10.04	12.34	14.73
36-7P	12.89	13.04	8.64	13.09	13.58
36-8S	10.92	12.40	9.97	11.98	14.22
36-8P	11.50	11.70	8.78	12.89	13.48
36-9S	12.94	12.78	10.76	13.27	14.44
36-9P	9.48	11.01	8.44	12.14	12.48
36-10S	12.84	12.84	10.84	14.47	14.18
36-10P	15.04	15.04	13.04	17.16	16.84
36-11S	8.74	8.74	6.12	9.93	10.43
36-11P	7.00	7.76	5.09	8.38	9.01
36-12S	9.42	9.77	7.16	10.88	11.28
36-12P	9.42	9.77	7.16	10.88	11.28
36-13S	12.78	12.78	10.84	14.35	14.64
36-13P	8.89	10.17	8.09	9.88	11.94
36-14S	10.12	10.26	7.85	11.16	11.94
36-14P	10.12	10.26	7.85	11.16	13.77
36-19S	11.99	9.04	9.81	11.34	12.27
36-19P	9.26	10.90	7.04	13.09	12.58

MOTOR GENERATORS

2.5 KVA Diehl Elec. Co. 120 V.D.C. to 120V A.C. 60 cy. 1Ph., .4PF. Complete with Magnetic Controller, 2 Field Rheos and Full Set of Spare Parts including Spare Armatures for Generator and Motor. Full spec. on request. New.....$285.00

2 KVA O'Keefe and Merritt. 115V DC to 120V AC. 50 cy. Idles at 3 Ph. synco motor on 208V, 50 cy. New. Export crated.....$165.00

1.25 KVA Allis-Chalmers. 230 DC to 120 AC, 60 cy. 1 Ph. Fully enclosed. Splashproof, Ball Bearings, centrifugal starter. New, complete with kit of Spare parts.....$175.00

M.G. 184, Holtzer-Cabot Motor: 440V, 3Ph, 60 cy., 90A. 1/2HP, 1750 RPM. Generator: 70V, 3Ph, 144 Cy., 140KVA. Exciter: 115DC, 1A. New...$67.50

Type CG-21302. 440 V AC, 60 cy., 3Ph., 1500 VA to 875 DC and 300V DC. New.....$69.50

INVERTERS

Onan MG-215H. Navy type PU/13. Input 115/230, 60 cy, 1 Ph. Output 115, 480 c. 1 Ph. 1200W and 28V DC at 4 amps. New.....$295.00

G.E. Model 5D-21NJ3A. Input: 24V, DC. Output: 115V, 400 cy., 485 Va. New.....$29.50

Leland Elec. Co. Model PE206A. Input: 28V, DC, 38 Amps. Output, 80V., 800 cy, 485 VA. New $22.50

G.E. J5169172. Input: 28V, DC. Output: 115, 400 cycles at 1.5 KVA.....$32.50

DYNAMOTORS

Navy-Type CAJO-211444, 105/130V DC to 13V DC at 40A or 26V DC at 20A. Radio Filtered. Complete with Line Switch. New.....$80.50

Elcor, 24V DC to 110V AC, 60 cy. 1 Ph. 2.04 Amps. New $24.50

Elcor, 32V DC to 110V AC, 60 cy, 1 Ph, 0.43 Amps. New $22.50

Type PE94C. For use with SCR522 Transmitter-Receiver. Brand new in export cases.....$15.00

Carter 6V DC to 400V DC at 375 mils. New $39.50

AMPLIDYNES

G. E. Model 5AM21J17. 4600 R.P.M. Motor Compound wound. 150 Watts. Input: 27V DC. Output: 60V DC. Sig. Corps. U. S. Army MG-27-2. New $34.50

Edison type 5AM3INJ18A. Input: 27 volts, 44 Amps., 3500 RPM. Output: 60V DC at 8.8 amps. 530 Watts. New.....$22.50

SMALL D.C. MOTORS

G.E. Model 5BA50LJ2A. Armature 27V D.C. at 8.3A. Field 60V DC at 2.3A. RPM 4000. H.P. 0.5 New $27.50

Electrolux Corp. of Canada. P/O vent fan assembly for SCR-602-T6. 1/35HP, 28.5V, 2.15 amps., 2200 RPM. Price.....$18.50

Outer type E-7-5, 27.5V, 1/20HP, 2650 RPM. Shunt wound. Price.....$15.00

Dumore Co. Type EBLG, 24V DC, 40-1 gear ratio, for use with type B-4 Intervalometer. Price $47.50

Ford Inst. Co. Type 58DG. Brand New....$22.50

Electrolux Torque Motor.....$10.50

FL BLOWER SYNCHROS

Westinghouse 115v. 400 cy. 17 c.f.m. Includes capacitor. Price $12.50

BASIC SCOPE UNIT

For 80/115V, 400/2600 cycles
Part of Panadapter AN/APA-10

Consists of two chassis containing complete high and low voltage supply, 150V DC and 300V DC filtered and regulated and 400V DC and 1200V DC filtered. CR tube socket part of chassis. Uses 3IB1, 2-VR150, 5R4G, 2x2 and 6AK5 DC resistor tube. Has controls for intensity, focus, aux. focus. Brand New less tubes.....$29.50

TEST EQUIPMENT

TS-127/U Lavoie Freq. Meter—375 to 725 MC.
TS-47APR Test Osc. 40-500MC.
TS-48/U Peak to Peak VTVM.
AN/APR-1 Receiving sets less tuning units.
R1121A/APR-5A Receiver—1000 to 6000 MC.
AN/APR-4 Tuning Units TN-17 (76300 MC).
AN/APR-4 Tuning Units TN-18 (300-1000 MC).
AN/APR-4 Tuning Units TN-19 (950-2200 MC).
TU-5B Range "A" Tuning Units (110-370 MC).
BC1206 APN-4 Test Sets.
AN/APA-10 Panoramic Adapters 115V/60 cycles.

RADAR

Antenna-Trans-Rec Unit ASG-1.
Radar Set SQ complete with spares.
Modulator type SQ-11.
Pulse Timers CU5-50AGD (SD-5 Radar)
Radar Crystal Units 98.35kc, Raytheon.
1N21B Sylvania Diodes.
Repeater Adapters CRM-50 AFO.
SO Series Accessory Control Panels.
SO Series Transmitter-Receiver unit
CARD 23AEK Bearing Control Units for SO Series.
Auxiliary Rectifier.
SG Rectifier Power Units CRP-20ABN.
SG Rectifier Power Unit CRP-20ABM.
SQ Modulation Generators CRP-35AAH.
SG Radar Receivers CRP-46ABD-1.
SG Complete trans. RF Coupling Assemblies.
SG Power Control Chassis.
SG Driver Modulator Assemblies.
SG Complete sets equipment spares.
SG Load Divider Modernization kits.

CRYSTALS—W.E. TYPE CR-1A/AR

5910 - 6350 - 6370 - 6470 - 6510 - 6810 - 6670 - 6690 - 6940 - 7270 - 7350 - 7380 - 7390 - 7480 - 9720 Kilocycles. Available in quantity.
Price .....$1.25 each

REPLACEMENT PARTS FOR BC348 MODELS H, K, L, R AND BC 224 F, K

We can supply for above models only:
All coils for Ant., RF., Det. and Osc. bands.
All I.F. trans., including C. W. Osc. and xtal filters.
4 gang condensers, engraved front panels, complete dial mechanism assemblies, etc.
Write for complete listing.

AMPLIFIERS

GE Servo type 2CY1C1 400 cycle
Constant Output Line BC-759C
Synchro Amplifiers for Radar
Intercommunication type BC-605

ANTENNAS

Coast Guard MR-162 Whips 23¼ ft.
Microwave types AT-49, AT-38, AS-125
APT-2 Dipole Antennas
TDY Radar Jammer Horns
Paraboloids, Magnesium Dishes 17⅛" dia.
SCR 634-A (Part of RC-153-B Antenna).

POTENTIOMETERS

W.E. KS-15138 Linear Sawtooth
W.E. KS-8732 for SCR547 Radar
W.E. KS-8801 Motor Driven

RECTIFIERS

G.E. No. 6 RC39F16 for 54 cells 10 amps.
G.E. No. 6 RC133F9—In: 110/220/60/1. Out: 15/30V-75-150A
Mallory APS-20—In: 115/230/60/3. Out: 12/24V-65-130A
Turret Trainer Supply. In: 220/60/3. Out: 28V-130A
RA20 Vibrator Power Supply
Complete specs on request

MISCELLANEOUS

SCR522 Transmitter Receivers Brand New
TCR Transmitters 125 watt Ship to Shore
RC966A Transponders
RTT AN/AIN-1 Receivers
RC-423B Modulators
BC-1366M Jack Boxes—Large quantity
Sweep Generator Capacitors 5/10 mfd.

TERMS: Rated Concerns Net 30, FOB Bronxville, New York. All Merchandise Guaranteed. Prices Subject to Change

400 CYCLE TRANSFORMERS

AUTO. 400 cy. G.E. Cat No. 80G184. KVA .9485-.5301 Volts 460/345/200/115. Now $4.95
FILAMENT. 400/2600 cy. Input: 0/75/80/85/105/115/125V. Output: 5V3A/.5V3A/5V5A/5V2A 5V6A/5V6A/6.3V6A/6.35A. New $2.95
THYRATRON POWER. 400/1600 cy. Raytheon UX-8676. 400/1600 cy. Pri: 115, Sec: 50-0-50V at 1.5A. 6.3V at 1.2A. Test r.m.s. 1780. New....$2.75
PLATE WECO KS9560, 400/800 cy. Pri: 115V, Sec: 1250-0-1250 at .037A (2700 V Total). Elecstat shided. Wt. 2.3 lbs. New.....$2.95
Plate. Thordarson #T46S03. 1650 VA. Pri: 105-130V. 500 cy. 1 PH. Sec: 5600V. Center tapped. 1.5KV insulation. Brand new.....$49.50
PLATE & FIL. WECO KS9555, 400 cy. Pri: 115V. Sec #1: 930-0-930. Sec #2: Three 6.3V windings $3.95
FILAMENT. 400/2400 cps. WECO KS9553. Pri: 115V. Sec: 8.2V1.25A/6.35V1.5A Elecstat shdld. Wt. 2.3 lbs. New.....$1.95
PLATE & FIL. 400/2600 cy. Pri: 0/80/115V. Sec: #1=1200VDC at 1.5MA. Sec. #2=400VDC at 130MA. Fil. Secs: 6.4V4.5A/6.35VO.6A (Ins. 1500V)/5V2A/5V2A.....$4.95
RETARD. 400 cy. WECO KS9598. 4 Henry 100MA. $1.75

60 CYCLE TRANSFORMERS

FILAMENT. Raytheon Hypersil Core. Pri: 115V. Sec: 6.3V22A/6.3V2.4A/6.3V2.25A/6.3VO., 6A Ins. for 1700V $3.95
High Reactance Trans. G. E. type Y-3502A.....60 cy. Voltage 11200-135. Inductance H.V. Winding 135 Henries. Output: Peak Voltage 22.6KV. Cat. 931B065G1. New $99.50
High Voltage Trans. Westinghouse Pri: 115, 60 cy. Sec: 15,000 C.T., 60 MA. Good for Hi-Pot test set up. C. T. ungrounded.....$29.50

PULSE TRANSFORMERS

PULSE. WECO KS-9563. Supplies voltage peaks of 3500 from 807 tube. Tested at 2000 Pulses/sec and 5000V peak. Wdg. 1-3=18 ohms. Wdg. 1-3=72 ohms. 2 of Wdg. 1.3=.082H at 100 cps.....$5.00
PULSE. WECO KS-161310, 50 KC to 4MC, 1⅝" Dia. x 1⅞" high, 130 to 2350 ohms. New....$1.95

RAYTHEON VOLTAGE REGULATOR

Adj. input taps 95-130V., 60 cy. 1 Ph. Output: 115V., 60 Watts, ⅛ of 1% Reg. Wt. 20 lbs. 6¼" H x 8¼" L x 4⅝" W. Overload protected. Sturdily constructed. Tropicalized. Special.....$14.75

RELAYS

Struthers-Dunn 1BXX129, 110 D.C.
Advance type 455C, SPDT, 115 A.C.
Leach type 1154A, SPDT, 115 A.C.
Leach type 1064, DSN 30-28V D.C.
Clare Plug-in base No. 30FMX 115 A.C.
G.E. Plug-in base Sensitive K27J863
Allied Control type BJ 452-1128
Western Electric D-163781 Plug-in
Guardian Time Delay type B-9-SPDT
Haydon Time Delay 17717 110V/60

SONAR EQUIPMENT

Hoist Train Mechanisms, Navy type 78319, for Model QBG, Underwater Sound equipment. Purpose: To lower or raise projector. Travel 3'3". Includes 1 partial set of spare parts, 1 wooden box per set; Weight and cube per box: 427 lbs., 42.0 cu.

MISCELLANEOUS

Cathode Ray Shields for 3" tube.....$3.75
Variac type Motor Controls 600 watt.....$13.50
10 CM Waveguide 90° elbow.....$20.00
Adel Clamps assorted types—write for samples
Shock Mounts Navy #20.....$.40
Shock Mounts U. S. Rubber #5150C.....$.30
Commando Pole Jacks (Cook Elec. Co.).....$1.00
Fusetron (Bus FRN 30 Ampere 250V).....$.25
Switchboard Lamp Receptacles & Jewels.....$.40

SOUND POWERED PHONES

Western Electric No. D173312. Type O. Combination headset and chest microphone. Brand new including 20 ft. of rubber covered cable.....$17.50
Automatic Elec. Co. No. GL643AO. Similar to above but including Throat microphone in addition to chest microphone. Brand new with 20 ft. rubber covered cable $16.00
U. S. Instrument Co. No. 1268. Complete with 20' cable and plug. Brand new.....$17.50
W. E. type TS-10M Handset. New.....$16.50

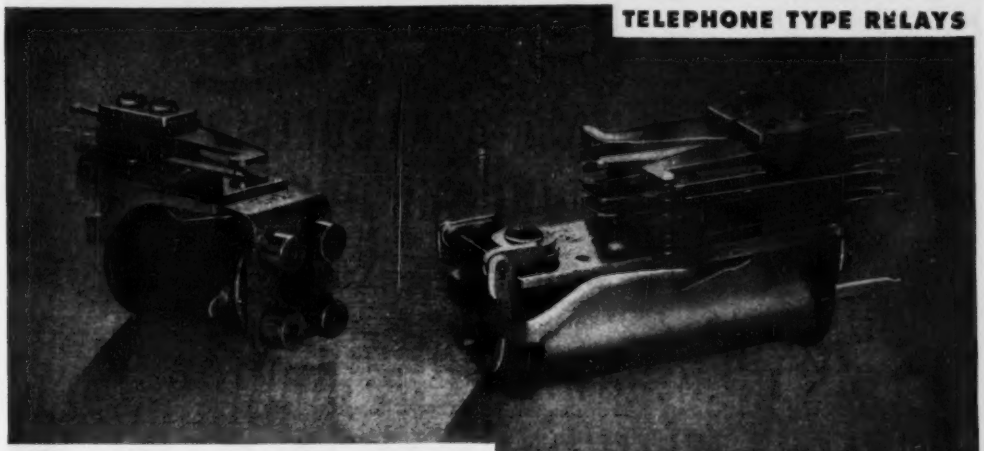
HI-VOLT CAPACITORS

.25 Mfd., 20KV.....$26.50
.25 Mfd., 15KV.....$22.50
.5 Mfd., 25KV.....$34.50
1 Mfd., 15KV.....$34.50
1 Mfd., 7.5KV.....$12.50
2 Mfd., 6.0KVA.....$14.50

ELECTRONICRAFT
INC.
27 MILBURN ST BRONXVILLE 8, N. Y.
PHONE BRONXVILLE 2-0044

INDICATORS

ID-24/ARN-9 .....$12.50
ID-14/APN-1 .....$14.50
1-82A $9.75
ID-60/APA-10 Panoramic Adapter converted for 60 cycle operation—complete with tubes and 80 page Tech. Manual $245.00



RELAYS

This list represents only a small part of more than a million relays in our stock—one of the world's largest. All relays are standard, brand new in original packing, and fully guaranteed by Relay Sales.
Send us your relay requirements. If the items are in stock we can make immediate delivery at substantial savings in cost to you.

SHORT TELEPHONE RELAYS

STK. NO.	VOLTAGE	OHMAGE	CONTACTS	UNIT PRICE
R-635	12 VDC	100	1C&1B	$1.35
R-308	12 VDC	100	2C @ 4 Amps	1.85
R-343	12 VDC	100	1C	2.00
R-826	12 VDC	150	2C, 1B	1.55
R-770	24 VDC	150	1A/10 Amps	1.45
R-368	8/12 VDC	200	1B	1.40
R-771	24 VDC	200	1A/10 Amps	1.45
R-603	18/24 VDC	400	2A	1.55
R-575	24 VDC	500	2C	2.40
R-764	48 VDC	1000	1C&2A	2.00
R-417	5.5 ma	5800	2C	2.50
R-563	60/120 VDC	7500	1A	2/3.10
R-213	5.8 VAC 60 Cy.	....	2A	2.50
R-801	115 VAC	....	NONE	1.45
R-589	12 VDC	125	2A	1.30
R-113	12 VDC	150	4A	1.55
R-689	12/24 VDC	255	1C	1.55
R-799	24 VDC	500	NONE	1.00
R-115	24 VDC	500	1C	1.70
R-110	24/32 VDC	3500	1C	2/3.45
R-121	150 VDC	5000	2A&1C	2.05
R-122	150 VDC	5000	2C/Octal Base	2.50
R-634	150/250 VDC	6000	1A&1B	2.45
R-369	8/12 VDC	150	2A, 2B	1.60
R-908	6 VDC	15	4A @ 4 Amps	1.50
R-800	12 VDC	150	2C&1A	1.55
R-537	12/24 VDC	150	2C&1B	2.00
R-750	24 VDC	400	1A	1.60
R-367	10/16 VDC	195	2C	2.50
R-335	20/30 VDC	700	2A, 1C	2.00
R-366	30/120 VDC	4850	1C	2.50

STANDARD TELEPHONE RELAYS

STK. NO.	VOLTAGE	OHMAGE	CONTACTS	UNIT PRICE
R-806	115 VAC	900	1A	$2.05
R-161	6 VDC	10	2B&1A	1.10
R-873	6 VDC	12	3C-3A MICALEX	3.00
R-305	12 VDC	50	2A Split Cerm.	1.35
R-360	24 VDC	200	1C	1.50
R-484	24 VDC	200	2A, 1C	1.35
R-337	24/48 VDC	1200	1A, 2B Split	2.65
R-101	24 VDC	1300	2A	2.50
R-868	30/162 VDC	3300	1C	1.90
R-365	52/162 VDC	3300	4C	3.95
R-518	85/125 VDC	6500	1C	3.60
R-918	52/228 VDC	6500	1C	3.60
R-852	52/228 VDC	6500	1C, 1A	3.00
R-341	75/228 VDC	6500	4C @ 4 Amps	3.65
R-633	180/350 VDC	10,000	1C @ 5 Amps	2.90
R-344	72/300 VDC	11,300	3A, 1B	2.45
R-332	100/350 VDC	40,000	2A	3.50
R-664	110 VAC	....	2B&1A/OCT.SOCKET	2.45
R-667	6 VDC	.75	1B/10AMP. 1A/3AMP.	1.45
R-632	6 VDC	12	5A&1C	3.25
R-154	6/12 VDC	200	1A	1.50
R-517	12 VDC	250	2A	1.50
R-116	85 VDC	3000	1B	3.05
R-631	100/125 VDC	3300	2A	1.90
R-545	110/250 VDC	7000	1C	2.40
R-124	300 VDC	12,000	1A	1.55
R-511	24 VDC	200	W/MICRO N.O.	3.05
R-160	6 VDC	12	3C&3A	3.00
R-851	52/228 VDC	6500	1C, 1A	3.00
R-591	6 VDC	40	1B&1C	1.35
R-155	12 VDC	100	4A&4B	1.45
R-520	200/300 VDC	14,000	2C	3.45
R-159	6 VDC	50	2A	1.35
R-158	6 VDC	50	4A Cerm.	1.85
R-381	6/8 VDC	100	1A Split	2.50
R-382	6/12 VDC	200	1B Split	2.50
R-153	12 VDC	200	1C&1A	1.55
R-304	12 VDC	200	4A Split Cerm.	2.50
R-383	6/12 VDC	500	1A Split	2.50
R-385	6/12 VDC	500	1B Split	2.50
R-384	6/12 VDC	500	3A Split	3.00
R-576	12 VDC	200	2A	2.50
R-316	24 VDC	200	1C	1.50

OTHER RELAY TYPES IN STOCK

- Keying Relays
- Rotary Relays
- Contactors
- Midget Relays
- Voltage Regulators
- Differential Relays
- Sealed Relays
- Special Relays

Relay Sales

Manufacturers and Distributors:
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Our engineers have had production and purchasing experience—and their only responsibility is to help you get the parts you need.

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24-72 HOUR DELIVERY

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8S-1P	16S-4S	18-15S	20-10S	22-8S	24-7P	28-7P	32-3S	36-1P
8S-1S	16S-5P	18-16P	20-11P	22-10P	24-7S	28-7S	32-5P	36-1S
10S-2P	16S-5S	18-16S	20-11S	22-10S	24-9P	28-9P	32-5S	36-11P
10S-2S	16S-6P	18-17P	20-12P	22-11P	24-9S	28-8S	32-6P	36-11S
10SL-3P	16S-6S	18-17S	20-13P	22-11S	24-10P	28-9P	32-8S	36-12P
10SL-3S	16S-8P	18-18P	20-13S	22-12P	24-10S	28-9S	32-7P	36-12S
10SL-4P	16S-8S	18-18S	20-14P	22-12S	24-11P	28-10P	32-7S	36-14P
10SL-4S	16-15P	18-20P	20-14S	22-13P	24-11S	28-10S	32-8P	36-14S
10SL-656P	16-15S	18-20S	20-15P	22-13S	24-12P	28-11P	32-8S	36-15P
10SL-656S	16-16P	18-22P	20-15S	22-14P	24-12S	28-11S	32-9P	36-15S
12S-1P	16-16S	18-22S	20-16P	22-14S	24-15P	28-12P	32-9S	36-16P
12S-1S	16-2P	18-23P	20-16S	22-15P	24-15S	28-12S	32-10P	36-16S
12S-2P	16-7P	18-23S	20-17P	22-15S	24-16P	28-13P	32-10S	36-17P
12S-2S	16-7S	18-24P	20-17S	22-16P	24-16S	28-13S	32-13P	36-17S
12S-3P	16-9P	18-24S	20-19S	22-16S	24-18P	28-14S	32-13S	36-18P
12S-3S	16-9S	18-25P	20-20P	22-17P	24-18S	28-15P	32-14P	36-18S
12S-4P	16-10P	18-25S	20-20S	22-17S	24-19P	28-15S	32-14S	36-19S
12S-4S	16-10S	18-26P	20-22S	22-18P	24-19S	28-16P	32-16P	36-20P
12-5P	16-11P	18-26S	20-23P	22-18S	24-20P	28-16S	32-16S	36-21P
12-5S	16-11S	18-27P	20-23S	22-19P	24-20S	28-17P	32-18P	36-21S
12S-6P	16-12P	18-27S	20-24P	22-19S	24-21P	28-17S	32-18S	36-646P
12S-6S	16-12S	18-28P	20-24S	22-20P	24-21S	28-18P	32-19P	36-697P
14S-1P	16-13P	18-28S	20-25P	22-20S	24-24P	28-18S	32-19S	36-697S
14S-1S	16-13S	18-29P	20-25S	22-21S	24-24S	28-19P	32-20P	36-799P
14S-2P	18-1P	18-29S	20-26P	22-22P	24-25P	28-19S	32-20S	36-799S
14S-2S	18-1S	18-30P	20-26S	22-22S	24-25S	28-20P	32-101P	40-1P
14S-4P	18-2P	18-30S	20-27P	22-23S	24-26P	28-20S	32-101S	40-1S
14S-4S	18-2S	18-31P	20-27S	22-24P	24-26S	28-21P	32-102P	40-2P
14S-5P	18-3P	18-31S	20-28S	22-24S	24-28P	28-21S	32-102S	40-6P
14S-5S	18-3S	20-1P	20-28P	22-27P	24-28S	28-22S	32-722P	40-8P
14S-6P	18-4P	20-1S	20-29P	22-27S	24-684P	28-684P	32-722S	40-9P
14S-6S	18-4S	20-2P	20-29S	22-30P	24-684S	28-684S	32-810P	40-9S
14S-7P	18-5P	20-2S	20-30P	22-30S	24-691P	28-693P	32-810S	40-11P
14S-7S	18-5S	20-3P	20-30S	22-32P	24-691S	28-693S	32-911P	40-11S
14S-9P	18-6P	20-3S	22-1P	22-32S	24-710P	28-695P	32-911S	40-13P
14S-9S	18-6S	20-4P	22-1S	22-36P	24-710S	28-695S	36-1P	44-1P
14S-10P	18-8P	20-4S	22-2P	22-36S	24-835P	28-702P	36-1S	44-1S
14S-10S	18-8S	20-5P	22-2S	24-1P	28-1P	28-702S	36-2P	44-2P
14S-11P	18-9P	20-5S	22-3P	24-1S	28-1S	28-745P	36-2S	44-2S
14S-11S	18-9S	20-6P	22-3S	24-2P	28-2P	28-745S	36-3P	44-4P
14S-12P	18-10P	20-6S	22-4P	24-2S	28-2S	28-840P	36-3S	44-4S
14S-12S	18-10S	20-7P	22-4S	24-3P	28-3P	28-840S	36-6P	44-5P
14-3P	18-11P	20-7S	22-5P	24-3S	28-3S	28-852P	36-6S	44-5S
14-3S	18-11S	20-8P	22-5S	24-4P	28-4P	28-852S	36-7P	44-6P
16S-1P	18-12P	20-8S	22-6P	24-4S	28-4S	32-1P	36-7S	44-6S
16S-1S	18-12S		22-6S	24-5P	28-5P	32-1S	36-8P	44-8S
16S-3P	18-13P	20-9P	22-8P	24-5S	28-5S	32-2P	36-8S	48-1P
16S-3S	18-13S	20-9S	22-8S	24-6P	28-6P	32-2S	36-9P	48-1S
16S-4P	18-15P	20-10P	22-9P	24-6S	28-6S	32-3P	36-9S	48-3S

3108-S

AN 3108-A

AN 3104

AN 3102

AN 3101

AN 3100

AN 3057

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"K" & "RK"			AVAILABLE AT THIS TIME		"K" & "RK"		"PL"	
WK	S.2	C.8	FK	V.15	LK	SHELLS	PL-U-9-U	PL-806
-1-	V.7	-9-			N.27	21	PL-112	PL-813
M.2	C.9	-12-	D.5	B.18	L.86	21.C	PL-122	PL-816
	M.10				-27-	22	PL-125	PL-Q-227
C.3	C.16	NK	M.3	IK	A.82	22.C	PL-147A	PL-P-230
-4-	-19-	L.8	V.3		AK	23	PL-149	PL-Q-230
S.4		S.10		V.9	D.39	23.C	PL-151A	PL-384
-6-	GK	-13-	L.5		G.82	24	PL-152A	PL-P-256
	-1-	M.16	-10-	-26-	AF	24.C	PL-153A	PL-P-257
SK	C.3	L.20	R.14	R.26]	C.8	21.S	PL-156A	PL-800A
C.3	S.3	C.23	L.16		D.3	21.SL	PL-P-300	
L.3	C.4	-27-	G.16	M.20]	D.4	22.S		
C.7	M.5				T.8	22.SL		

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Universal general corp.

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Capacitors	Hardware	Sockets
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Ceramics	Knobs	Switches
Chokes	Potentiometers	Transformers
Circuit Brushes	(also-cooling)	Tubes
Coils	Pulse Xfmrs.	And Others

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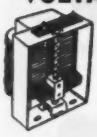

Amertran Transtat

90 to 130 V, 50-60 cyc, 17.5 Amps, #T282 ..... **$17.50**
103 to 126 V, 50-60 cyc, 2.17 Amps, #T283 ..... **$9.95**
W. E. D122855, 92 to 115 V, 400 cyc, 5.5 Amps, #T281 **$6.75—10 for $60.00**

2.5 AMP H.D. FILTER REACTOR

Amertran Type PBN 0.5 Hy, at 2.5 A, 2.3 Ohm, 2.5 KV insul, 5½ x 7 x 8" overall, Heavy Shield, #T284 ..... **$12.95**

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PP6L6 to Servo Mechanism with 10% Feed-Back Winding. Mu-Metal Core. Shielded #T285 ..... **$3.50**

PP6V6 & 6SN7 (Dual Unit) to Servo Mechanism with 10% Feed-Back Winding. Mu-Metal Core. Shielded. #T286 **$3.95**

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Multiple Line & Voice Coil to Multiple Line & Voice Coil. Good Fidelity. Kenyon S20130. Shielded. #T287 ..... **$2.25**

Input Line to Single or P.P. Grids. 500-ohm C.T. Primary. Overall Ratio 1:13.7, Kenyon 213089-1. Shielded. #T288 ..... **$2.25**

Multiple Line or Mike to Single Grid. 300-ohm C.T. Primary. Overall Ratio 600:1. Kenyon 213307-2. Shielded. #T289..... **$2.25**

P.P. INTERSTAGE. Single or P.P. Plates to P.P. Grids. Ratio 1:1.2. Hi-Fidelity. Stancor 87A15. Shielded. #T112..... **$2.50**

120 CYCLE FILTER

Input Impedance: 1000 ohm, Output Impedance: 1000 ohm, Kenyon 213104-1. Shielded. #T289 ..... **$3.95**

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5 to 30 Hys, 125 Ma, 200 Ohm, S.C. Stock #4G1668C/R1, 2000V Test, Shielded. #T111 **$3.49**

5 to 20 Hys, 300 Ma, 90 Ohm, 2000V Test, Shielded, #T290 **$3.95**

SHOCKMOUNTS

Series	Mfgr	Lb	Ea	Series	Mfgr	Lb	Ea
100	Lord	1	.10	200	Lord	35	.38
100	Lord	2	.10	200	Lord	45	.45
100	Lord	4	.12	200PH	Lord	6	.35
100	Lord	8	.15	200PH	Lord	10	.35
100	Lord	9	.18	200PH	Lord	12	.38
150	Lord	8	.20	250PH	Lord	15	.40
150	Lord	10	.20	250PH	Lord	45	.4n
150	G'year	25	.25	**OTHER MOUNTS**			
150PH	Lord	4	.25				
150PH	Lord	6	.25	VX1021 Harris 2 oz			.10
200	Lord	10	.28	3/4" Dia Lord 2 Lb			.10
200	Lord	20	.30	279 Series 250 Lord			1.00
200	Lord	25	.35	C2030 Barry			1.00

MICROSWITCHES 10 Amp 125 V

Type	Action	Actuator	Ea.
YS2R5	SPST n.o.	Pin	.59
BZ2R5	SPDT	Pin	.69
V312	SPST n.o.	Wire	.69
WZ3RTC	SPST n.c.	Pin	.59
AFR301	SPST n.o.	Plunger	.79
WZR31	SPST n.c.	Plunger	.79
WZ57RQNT	SPST n.c.	Plunger	1.50

Enclosed Type

ACRO SWITCHES

2MC31A	SPST n.c.	Pin	.59
2MD21A	SPDT 6A	Pin	.69
2MD31A	SPDT	Pin	.79
XC72L	SPST n.c.	Leaf	.79

OTHER SENSITIVE SWITCHES

C-H 8911K524 DPST n.o. Plunger..... .79
MuSwitch DGBP32 SPST n.o. Plunger..... .95

TOGGLE & PUSH SWITCHES

Contacts	Mfgr. & No.	Description	Amps	Ea
SPST	Carling	Small Toggle	3A, 110V	.15
SPST	A, H&H	Toggle	3A, 250V	.29
SPST	C-H B5A	Aircraft	35A, 24V	.29
SPDT	C-H B9A	Aircraft	35A, 24V	.39
SPDT	A, H&H	Toggle	3A, 125V	.29
DPST	A, H&H	Toggle	3A, 125V	.39
1 B*	A, H&H	Momentary	5A, 125V	.23
1 B*	T&M Co.	Push	3A, 125V	.29
1 A*	Square D	Push	15A, 24V	.49

* 1A = SPST n.o. 1B = SPST n.c.

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110V 60 Cyc TIMING MOTORS

INGRAHAM 8 RPM Fully Enclosed..... **$1.95**
TELECHRON 3.6 RPM..... **2.50**
GILBERT With Gear Train for 6 RPDay.. **1.95**
GILBERT 60 RPM (1 RPS)..... **1.75**

OIL FILLED CAPACITORS

BATHTUBS

Mfd.	WVDC	Term	Ea	Mfd.	WVDC	Term	Ea
2x0.1	600	Bot.	.35	2x0.64	600	Side	.45
3x0.1	600	Bot.	.40	1.0	400	Side	.55
0.2	440AC	Side	.40	2x1.0	600	(2)Side	.65
0.25	600	Top	.40	2.0	600	Bot.	.65
0.5	600	Bot.	.45	4.0	50	(1)Side	.65
0.5	600	Top	.48	100	25	(2)Side	.65
0.5	400	Side	.45	50	25	(1)Side	.30

CHANNEL

Mfd.	WVDC	Term	Ea	Mfd.	WVDC	Term	Ea
0.015	600	Top	.28	2x0.5	200	(2)Bot.	.35
2x0.1	600	Bot.	.35	0.5	400	Bot.	.40
3x0.1	400	Bot.	.40	0.5	600	Bot.	.48
3x0.1	600	Bot.	.45	1.0	400	Bot.	.48
2x0.25	600	(2)Bot.	.48	1.0	400	Top	.48

RECTANGULAR

Mfd.	WVDC	Ea	Mfd.	WVDC	Ea
2x0.1	7000	1.49	1.0	2000	1.85
0.2	5000	2.25	1.5	330AC	.89
0.25	4000	1.95	5	25	.49
0.75	1000	.69	7	600	1.45
1.0	400	.30	3x8	5	1.95
1.0	600	.65	17.5	330AC	3.25
1.0	1500	1.49	Filterette	50V3A	.59

ROTARY RATCHET RELAYS

Ledex D.C. Impulse operated mechanisms rotate in 30 steps. Ratchet mechanism has ¼" shaft with flats for standard switch wafers.

#33 Mechanism only, 24V. 200 ohm, #R597 ..... **$1.50**
#76-2945 Mechanism & Ratchet & 3" long shaft, 6V, ½ ohm, #R598 ..... **$3.50**
#75-3576 Mechanism & Ratchet & 4" long shaft, 6V, ½ ohm, #R599..... **$3.75**
#25 Mechanism Only, 12V, 4.5 ohm, #R824 **$1.50**
#26 Mechanism Only, 6V, 2 ohm, #R825 **$1.50**
Miniature Mechanism Only, 12V, 35 ohm, #R826 ..... **$1.50**
Miniature Mechanism Only, 6V, 10 ohm, #R827 **$1.50**

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WANTED! WANTED!
MILITARY TEST SETS & EQUIPMENT
TS-13, 13, 35, 14, 15, 148, 174, 175, 243, 268, etc. APR, ARC, ART, APS, APA, SCR, BC equipment and parts. Also TUBES, any quantity. WRITE, WIRE OR CALL.

R·H·S
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Coaxial Relay K-101 SPDT—24v DC ..... $ 4.95
Set of RS-18P Coax-Connectors for Above 1.35
1000 KC Crystal FT 243 ..... 2.45
VR-2 Vacuum Switch 2.40
Sigma Plate Relay 5000 ohm SPDT 3.45
RG-59/U Coaxial Cable—TV spec.
150' roll ..... $11.95, 500' roll 32.50
25' Coax Shield 2.95
2000-0-2000 V @ 500 MA Xformer 34.50
15 HY @ 500 MA Choke 4.25
2 mfd 5000 V Condenser 4.25

TUBES!! BRAND NEW! STANDARD BRANDS! NO SECONDS! COMPARE! TUBES!!

OA3/VR75 $1.69	3C24 ... $2.25	217C ... $6.95	812H ... $6.90	8008 ... $7.95	WL416 ... $37.50	5Y4G ... $0.73	6SL7GT ... $0.88	12SL7 ... $1.05
OB3/VR90 1.29	3C27 4.95	227A/5C27 5.95	813 6.95	8011 ... 1.95	WL417 ... 34.50	5Z3 ... .89	6SN7GT ... .98	12SN7 ... .98
OC3/VR105 1.49	3C27/C1B 4.95	250C ... 12.95	814 2.95	8012 ... 2.95	WL677 ... 34.50	5Z4 ... .69	6SQ7 ... .89	12SQ7 ... .89
OD3/VR150 1.29	3C45 ... 19.95	250R ... 12.95	815 2.95	8013 ... 2.95	WL681 ... 22.50	6A3 ... 1.25	6SR7GT ... .89	12SR7 ... .89
1B22 ... .89	3C47 ... 22.50	304TH ... 22.50	816 ... 23.95	8020 ... 1.29	OA2 ... 1.35	6A4LA ... 1.25	6SS7 ... .89	12SS7 ... .89
1B23 ... 12.50	3CP1SI ... 2.98	250TH ... 21.50	826 ... .98	8030 ... 1.29	OA4G ... 1.49	6A6 ... .92	6ST7 ... 1.10	12AT7 ... .89
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1B27 ... 24.50	3DP1-SZA ... 6.95	275A ... 1.95	832 ... 12.95	8052 ... 2.25	OD3 ... .75	6AB7 ... .89	6SZ7 ... .89	12AX7 ... .89
1B29 ... .75	3DP21A ... 6.95	304A ... 2.95	832A ... 12.95	8053 ... 2.25	1A3 ... .72	6AC7GT ... 1.20	6T8 ... 1.10	12BA6 ... .89
1B32 ... 2.95	3E29 ... 14.95	304A ... 2.95	832A ... 12.95	8054 ... 2.25	1A4P ... 1.00	6AD7 ... .89	6U8G ... .89	12BE6 ... .89
1B35 ... 24.50	3E50A ... 9.95	304B ... 2.95	833A ... 19.95	8055 ... 2.25	1A5GT ... .72	6AD7GT ... .89	6U8GT ... .89	12BH7 ... .89
1B38 ... 12.50	3GP1 ... 4.95	304TH ... 14.95	833A ... 41.50	9001 ... 2.25	1A6 ... .69	6AE8G ... .89	6V7G ... 1.05	12BY7 ... .89
1N21 ... $2.95	3HP1 ... 3.95	304TH ... 14.95	836A ... .98	9002 ... 2.25	1A7GT ... .89	6AF4 ... 1.49	6V8G ... .89	12CT7 ... .89
1N21A ... 3.25	4-65A ... 24.21	305A ... 24.95	837 ... .98	9003 ... 2.25	1AB5 ... .89	6AG5 ... .89	6V8GT ... .89	12DT7 ... .89
1N21B ... 3.25	4-125A ... 24.95	307A/RK72 ... 2.95	838 ... 2.95	9004 ... 2.25	1B3/8016 ... .89	6AG7 ... 1.40	6W7G ... 1.05	12DW7 ... .89
1N23 ... 3.25	4-250A ... 34.95	310A ... 5.95	841 ... .49	9005 ... 2.25	1B4 ... 1.15	6AH6 ... 1.40	6W7GT ... 1.05	12E1 ... 2.95
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1P40 ... 8.95	4E27/ ...	371B ... .98	866B ... 1.49	CL1006 ... 3.95	1E7G ... .72	6AU6 ... .79	7AD7 ... .89	12SL7GT ... 1.05
1P41 ... 8.95	4E27/ ...	371C ... 2.98	866JB ... 1.49	EL41 ... .98	1F4 ... .72	6AV6 ... .79	7B4 ... .89	12SN7 ... .98
2C21/RK23 ... .89	5AP1 ... 3.95	393A ... 5.95	869B ... 49.95	EF50 ... .98	1F5G ... .72	6B8G ... .89	7B5 ... .89	12SQ7 ... .89
2C22/717A ... 4.95	5AP4 ... 3.95	394A ... 5.95	872A ... 2.95	EF50 ... 2.25	1F6 ... .72	6BA6 ... .79	7B6 ... .89	12SR7 ... .89
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2C26A/RK34 ... .49	5BP4 ... 8.95	418A ... 4.95	876 ... 2.25	FG33 ... 24.50	1H4G ... .72	6BA8 ... .79	7C4 ... .79	12SC7 ... .89
2C39 ... 24.50	5CP1 ... 4.95	446A ... 4.95	878 ... 2.25	FM8 ... 27.50	1H5GT ... .72	6BC5 ... .79	7C5 ... .89	12SW7GT ... .89
2C40 ... 24.50	5CP7 ... 4.95	450TH ... 47.50	879 ... 1.49	FM9 ... 27.50	1H6GT ... 1.05	6BE6 ... .79	7C6 ... .89	12SW7 ... .89
2C43 ... 12.95	5C22 ... 12.95	450TH ... 47.50	885 ... 1.49	FM17 ... 1.95	1J6 ... .98	6BF6 ... .79	7C7 ... .89	12SX7 ... .89
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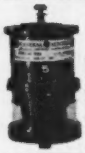

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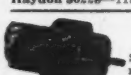

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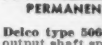

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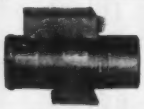
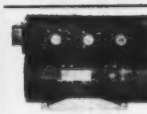


G.E. 5AS131NJ3 (PE-118) Input 26 VDC at 100 amps. Output 115 v. 400 cy. 1 φ at 1500 VA. PF 0.8 W.E. Spec. KS-5601L1. Stock #SA-286. **Price $59.50 ea.**



PE-218Einverters Russel Electric and Leland. Input 28 VDC at 92 amp. Output 115 v. 400 cycles at 1500 VA. PF 0.9. Stock #SA-112A. **Price $49.50 each.**

Pioneer 12130-4-B Input 28 VDC at 14 amps. Output 120 v. 400 cy. single phase at 1.15 amps. (140 VA.) Voltage and frequency regulated. Made 1949. Stock #SA-304. **Price $89.50 each.**

Leland SD-93—(10285)—Input 28 volts DC at 60 amps. Output 115 volts three phase 400 cycles at 750 va. 0.90 P.F. Second output voltage of 26 volts 400 cycles at 50 V.A. Voltage and frequency regulated. Designed for use with various autopilots. Stock #SA-209. **Price $99.50 each**

Aircraft Generator Eclipse NEA-3

Output 115 VAC; 10.4 amps 400 cycles at 3400 rpm. Also 30 VDC at 6 amps. Stock #SA-306. **Price $39.50 each.**

DC MOTORS

Haydon-0666, ½ rpm. 29 v. d-c, 100 ma.
General Electric 5BA50L366—⅛ hp. 27 v. field. Arm. v. 60, Amplidyne controlled.
Delco-A-7155—1/3 hp. 3600 rpm. Governor controlled.
W. E. KS-5003-LO2—1/100 hp. 4 lead shunt.
National Mineral—90600. 1 hp. Int. duty. Fan cooled.
Diehl FDE-53-5—3600 rpm. Governor controlled. 1/30 hp.
G. E. 5BA25MJ400—24 v. 7500 rpm. Cont. duty.
Airsearch—Actuator—25800-24. 2" travel.
Barber Colman—Actuator—YLc-2066-2. 200 in/lb. 135 degrees in 45 seconds.
Airsearch—Actuator (Manual Flap) 25050.
Airsearch—Actuator—(Automatic Flap) 25040.
Holtzer Cabot—RBD-2220—⅛ hp. 27 v. 3600 rpm.
Arma Latitude Motor — 8413-30 (Step motor)
Elinco B-64—1/165 hp. 3100 rpm. 27 v. f. 80 v. armature. (Thyratron control)
John Oster—A-21E-12R—Split field series reversible. 25 v. 0.4 amps. 2 watts output.
General Electric 5FS56HC18 — Split field series rev. 60 v. 1.4 A. 5500 rpm.

D-C ALNICO FIELD MOTORS

AC-SERVO MOTORS

Pioneer Type CK-2

26 v. 400 cycles fixed phase, var. phase 49 v. max. 1.05 in/oz. Stall torque. Rotor moment of inertia 7 gm/cm: With 40: 1 gear reduction. Large Qty.

Prices on Request

PIONEER CK-17

400 cycles 2 phase, 26 v. fixed phase. 45 v. max. variable phase. Built in gear reduction. Output shaft speed approx. 4 rpm. Stock #SA-287. **Price $16.50 each.**

FORD SERVO MOTOR

115 volt 60 cycle two phase low inertia motor. 15 watts output. B-Ord. 207927. Stock #SA-291. **Price $49.50 each.**

Pioneer Servo Motor

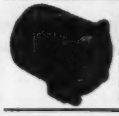
Type 10047-2A. 2 φ 400 cycle low inertia. 26 v fixed phase. 45 v. max. variable phase. Stock #SA-90. Price $12.50 each.

MICROWAVE ANTENNA

AS-217/APG 15B. 12 CM dipole and 12 inch Parabola housed in weatherproof Radome 16" dia. 24 v. DC spinner motor for conic scan. Stock #SA-95. Shipping wt. 70 lbs. Original boxes.

Price $14.50 ea.

A-5 Autopilot Indicator



Autosyn type Pilot Indicator for A-5 Autopilot. 26 v. 400 cycles. Stock #SA-299. Price $12.50 each.

Radio Compass Indicator

I-82F. Compass Indicator. 0-360°-5 in. dial. 26 v. 400 cy. 8-12 v. 60 cy. Ideal position indicator. Stock #SA-284.

Price $6.50 each

MAGNESYNS

Pioneer Type CL-3. 6 power.
Pioneer 1006-1E-B1 Indicator. AN-5730-2.

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Westinghouse Type FL—115 v. 400 cy. 17 c.f.m.

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TELECHRON SYNCHRONOUS MOTOR Type BC, 110 V., 60 Cy., 6 W., 60 RPM. PRICE $4.00 EA.

EASTERN AIR DEVICES, Type J33, Synchronous, 115 V., 400 Cy., 3 ϕ, 8000 RPM. PRICE $15.00 EA.

HAYDON TIMING MOTORS 110 V., 60 CY.

Type 1400, 2.2 W., 4/5 RPM. PRICE $3.00 EA.

TYPE 1600, 2.2 W., 1/240 RPM. PRICE $3.00 EA.

TYPE 1600, 2.3 W., 1 RPM. PRICE $3.00 EA.

TYPE 1600, 2.2 W., 1-1/5 RPM. PRICE $3.00 EA.

TYPE 1600, 3.5 W., 1 RPM. With shift unit automatic engaging and disengaging shaft. PRICE $3.75 EA.

TYPE 1600, 2.2 W., 1/60 RPM. PRICE $3.00 EA.

SERVO MOTORS

CK1, PIONEER, 2 ϕ 400 Cy. PRICE $10.00 EA.

CK3, PIONEER, 2 ϕ, 400 Cy. PRICE $14.00 EA.

CK2, PIONEER, 2 ϕ, 400 Cy., with 40:1 reduction gear. PRICE $15.50 EA.

10047-2-A, PIONEER, 2 ϕ, 400 Cy., with 40:1 reduction gear. PRICE $10.00 EA.

MINNEAPOLIS HONEYWELL Type B, Part No. G303AY, 115 V., 400 Cy., 2 ϕ, built-in reduction gear, 50 lbs. in torque. PRICE $10.00 EA.

MINNEAPOLIS HONEYWELL Amplifier Type G403, 115 V., 400 Cy., Used with above motor. PRICE $10.00 EA. WITH TUBES

REMOTE INDICATING COMPASSES 26 V., 400 CY.

PIONEER TYPE AN5730-2 Indicator and AN5730-3 Transmitter. PRICE $40.00 PER SET

KOLLSMAN TYPE 680K-03 Indicator and 679-01 Transmitter. PRICE $15.00 PER SET

D C MOTORS

JAEGER WATCH CO. TYPE 44K-2 Contactor Motor, 3 to 4.5 V. Makes one contact per second. PRICE $3.50 EA.

GENERAL ELECTRIC TYPE 5BA10AJ37, 27 V., 0.5 amps., 8 oz. in torque, 250 RPM. PRICE $10.00 EA.

BARBER-COLMAN CONTROL MOTOR, Type AYLC 3091, 27 V., 0.7 Amps., 1 RPM. Contains 2 adj. limit switches. 500 lbs. lbs. torque. PRICE $9.50 EA.

WHITE RODGERS ELECTRIC CO., Type 6905 No. 3 ,12 V., 1.3 Amps., 1¼ RPM, torque 75 in. lbs. PRICE $10.50 EA.

ENGINE HOUR METER

John W. Hobbs Model MI-277. Records running time up 1000 hours. 20 to 30 volts D.C. PRICE $15.50 EA.

INVERTERS

WINCHARGER CORP. PU-16/AP, MG750. Input 24 V. D.C., 60 Amps. Output 115 V., 400 Cy., 1 ϕ, 6.5 Amps. PRICE $100.00 EA.

HOLTZER CABOT TYPE 149F, Input 24 V. D.C. at 36 Amps., Output 26 V. at 250 V.A., 400 Cy., and 115 V., 400 Cy., at 500 V.A., 1 ϕ, PRICE $75.00 EA.

PIONEER TYPE 12117. Input 12 V. D.C., Output 26 V., 400 Cy. at 6 V.A. PRICE $30.00 EA.

PIONEER TYPE 12117. Input 24 V. D.C., Output 26 V., 400 Cy. at 6 V.A. PRICE $30.00 EA.

PIONEER TYPE 12116-2-A. Input 24 V. D.C., at 5 Amps. Output 115 V., 400 Cy., 1 ϕ at 45 watts. PRICE $100.00 EA.

GENERAL ELECTRIC TYPE 5D21HJ3A. Input 24 V. D.C. at 35 Amps Output 115 V., 400 Cy., 485 V.A., 1 ϕ. PRICE $35.00 EA.

LELAND PE 218. Input 24 V. D.C. at 90 Amps. Output 115 V., 400 Cy., 1 ϕ at 1.5 K.V.A. PRICE $47.50 EA.

PIONEER AUTOSYNS

TYPE AY1, 26 V., 400 Cy. PRICE $8.50 EA.

TYPE AY5, 26 V., 400 Cy. PRICE $8.50 EA.

TYPE AY14G, 26 V., 400 Cy. PRICE $15.00 EA.

TYPE AY14D, 26 V., 400 Cy. PRICE $15.00 EA.

TYPE AY54D, 26 V., 400 Cy. PRICE $10.00 EA.

TYPE AY131D Precision Autosyn. PRICE $35.00 EA.

PIONEER AUTOSYN POSITION INDICATORS & TRANSMITTERS

TYPE 3907-17. Dial graduated 0 to 360°, 26 V., 400 Cy. PRICE $30.00 EA.

TYPE 6007-39. Dual Dial graduated 0 to 360° 26 V., 400 Cy. PRICE $50.00 EA.

TYPE 4550-2-A Transmitter, 26 V., 400 Cy., 2:1 gear ratio. PRICE $20.00 EA.

VOLTAGE REGULATORS

LELAND ELECTRIC CO. TYPE B, Carbon Pile type. Input 21 to 30 V. D.C. Regulated output 18.25 at 5 Amps. PRICE $6.50 EA.

WESTERN ELECTRIC TRANSTAT VOLTAGE REGULATOR Spec. No. Y-122835, Load K.V.A. 0.5. Input 115 V., 400 Cy. Output adjustable from 92 to 115 V. PRICE $10.50 EA.

RATE OR TACHOMETER GENERATORS

EASTERN AIR DEVICES J36A, .02 V. D.C. per RPM. Max. speed 5000 RPM. PRICE $17.50 EA.

ELECTRIC INDICATOR CO. TYPE B68 Rotation Indicator, 110 V., 60 Cy., 1 ϕ. PRICE $14.00 EA.

GENERAL ELECTRIC TACHOMETER GENERATOR TYPE AN5531-1. Variable frequency, 3 ϕ output. PRICE $25.00 EA.

GENERAL ELECTRIC TACHOMETER GENERATOR TYPE AN5531-2. Variable frequency, 3 ϕ output. PRICE $30.00 EA.

ALL PRICES F. O. B. GREAT NECK N. Y.

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1F SPECIAL REPEATER, 115 V., 400 Cy. PRICE $20.00 EA.

2J1F3 GENERATOR, 115 V., 400 Cy. PRICE $10.00 EA.

2J1G1 CONTROL TRANSFORMER, 57.5/57.5 V., 400 Cy. PRICE $10.00 EA.

2J1F1 GENERATOR, 115 V., 400 Cy. PRICE $10.00 EA.

2J1H1 DIFFERENTIAL GENERATOR 57.5/57.5 V., 400 Cy. PRICE $10.00 EA.

5SDG DIFFERENTIAL GENERATOR, 90/90 V., 400 Cy. PRICE $20.00 EA.

5G GENERATOR, 115 V., 60 Cy. PRICE $30.00 EA.

W. E. KS-5930-L2 Size 5G, 115 V, 400 Cy. PRICE $10.00 EA.

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DIEHL TYPE S.S. FD6-23, 27 V., 10,000 RPM. PRICE $10.00 EA.

DELCO TYPE 5069466, 27 V., 10,000 RPM. PRICE $15.00 EA.

DELCO TYPE 5069370, 27 V., 10,000 RPM. PRICE $15.00 EA.

DELCO TYPE 5072400, 27 V., 10,000 RPM. PRICE $15.00 EA.

BLOWER ASSEMBLIES

JOHN OSTER TYPE MX215/APG, 28 V. D.C., 7,000 RPM, 1/100 H.P. PRICE $10.00

WESTINGHOUSE TYPE FL, 115 V., 400 Cy., 6,700 RPM, Airflow 17 C.F.M. PRICE $10.00 EA.

DELCO TYPE 5068571 Motor and Blower Assembly, P.M. Motor, 27 V., 10,000 RPM. PRICE $15.00 EA.

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8DJ11-PCY, INDICATOR, 24 V. Dial marked 0 to 360°. PRICE $7.50 EA.

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Hammett Electric Mfg. Co., Model SPS-130, Input Voltage AC 208 or 230, 60 cycle, 3 phase, 21 amps. Output 28 Volts, 130 amps, continuous duty. 37" high, 22½" wide, 21" deep. Contains DC Volt meter, DC amp meter and 8 point tap switch for variable output voltage. Brand new. Price $350.00.

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SPERRY A5 DIRECTIONAL GYRO, Part No. 656029, 115 V., 400 Cy., 3 ϕ. PRICE $25.00 EA.

PIONEER TYPE 12808-1 GYRO SERVO UNIT. 115 V., 400 Cy., 3 ϕ. PRICE $20.00 EA.

ALLEN CALCULATOR TYPE C1 TURN & BANK INDICATOR, Part No. 21500, 28 V. D.C. PRICE $15.00 EA.

TYPE C1 AUTO-PILOT FORMATION STICK, Part No. G1080A3. PRICE $15.00 EA.

PIONEER GYRO FLUX GATE AMPLIFIER Type 12076-1-A, 115 V., 400 Cy. PRICE $40.00 EA.

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OA3	1.50	2J31	29.95	5BP4	6.95	311A	7.95	723A/B	17.95	866A	1.79
OB2	2.00	2J32	69.95	5CP1	6.95	312A	3.95	724A	4.95	869B	37.50
OC3	1.75	2J36	105.00	5D21	27.50	323A	25.00	724B	6.95	872A	3.95
OD3	1.50	2J38	17.95	5JP1	27.50	327A	3.95	725A	9.95	878	1.95
C1A	4.95	2J42	150.00	5JP2	19.50	328A	9.95	726A	6.95	884	1.95
C1B	6.95	2J49	109.00	5JP4	27.50	350A	7.95	726B	56.00	885	1.75
1B21A	2.75	2J50	69.50	6C21	29.50	350B	5.95	726C	69.00	889R	199.50
1B22	3.95	2J61	75.00	C6A	3.95	357A	20.00	728AY	27.00	914	75.00
1B23	9.95	2J62	75.00	C6J	10.95	368AS	6.95	730A	28.95	931A	6.95
1B24	17.95	2K25	47.50	7BP7	7.95	371B	2.95	801A	1.00	954	.35
1B26	2.95	2K28	37.50	7DP4	10.00	385A	4.95	802	4.25	955	.55
1B27	19.50	2K29	27.50	12AP4	55.00	388A	2.95	803	7.95	956	.69
1B32	4.10	2K45	149.50	15E	2.95	394A	7.95	804	13.50	957	.29
1B38	33.00	2V3G	2.10	15R	.95	MX408U	.75	805	5.95	958A	.69
1B42	19.95	3B24	5.50	NE16	.45	417A	27.95	806	25.00	959	1.69
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1N21	1.35	3C24	1.95	35T	4.95	450TH	45.00	809	2.45	1280	1.95
1N21A	1.75	3C31	5.95	45 Special	.35	450TL	45.00	810	11.00	1611	1.95
1N21B	4.25	3DP1A	10.95	RK39	2.95	464A	9.95	811	3.15	1613	1.38
1N22	1.75	3E29	15.50	VT52	.35	471A	2.75	813	8.95	1616	2.95
1N23	2.00	SN4	5.50	RK72	1.95	527	15.00	814	3.95	1619	.89
1N23A	3.75	4A1	1.75	RK73	1.95	WL530	7.50	815	3.50	1622	2.75
1N23B	6.00	4B26	10.95	100TH	9.00	WL531	22.50	816	1.45	1624	2.00
1N26	8.00	4C27	25.00	FG105	19.00	700A/D	25.00	829	12.95	1625	.45
1N27	5.00	4C28	35.00	F123A	8.95	701A	7.50	829A	13.95	1851	1.85
1N48	1.00	4E27	17.50	203A	8.95	703A	6.95	829B	15.95	2050	1.85
1S21	6.95	4J25	199.00	211	.95	705A	3.95	830B	11.50	2051	1.80
2B22	4.95	4J26	199.00	217C	18.00	707A	17.95	832	7.95	8012	4.25
2B26	3.75	4J27	199.00	242C	10.00	707B	27.00	832A	9.95	8013	2.95
2C34	.35	4J31	199.00	249C	4.95	714AY	7.95	833A	49.95	8013A	5.95
2C40	20.00	4J32	199.00	250TL	19.95	715A	7.95	834	7.95	8020	3.50
2C43	27.00	4J33	199.00	274B	3.00	715B	18.00	836	4.95	8025	6.95
2C44	.90	4J37	199.00	304TH	15.00	715C	25.00	837	2.95	9001	1.75
2D21	1.75	4J38	89.00	304TL	14.50	717A	1.95	838	6.95	9002	1.50
2E22	3.75	4J39	199.00	307A	4.95	718AY/EY	48.50	845	5.59	9003	1.75
2E30	2.75	4J41	199.00			719A	29.50	849	52.50	9004	1.75
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TS 35 X Band Pulsed Signal Generator
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TS 146 X Band Signal Generator
TS 62, TS 102, TS 168
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S Band 3000 MC

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Supreme 564
TS 34 Oscilloscopes WE
TS 126

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1" x ½" waveguide in 5' lengths, UG 39 flange to UG40 cover...per length, $7.50
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Dual Oscillator, Mount. (Back to back) with crystal mount, tunable termination attenuating slugs.....$18.50
Directional Coupler. UG-40/U Take off 20 DB.....$17.50
2K25/723 AB Receiver local oscillator Klystron Mount, complete with crystal mount, Iris coupling and choke coupling to TR.....$22.50
TR-ATR Duplexer section for above.....$8.50
CU 108/APS 31 Direction Coupler 25 DB.....$25.00
723AB Mixer—Beacon dual Osc. Mnt. w/xtal holder.....$12.00
Waveguide Sections 2½ ft. long silver plated with choke flange.....$8.75
Rotary Joint choke to choke with deck mounting.....$17.50
3 cm mitred elbow "E" plane unplated.....$12.00
UG 39 Flanges.....$ .85
UG 40 Chokes.....$1.00
90 degree elbows, "E" or "H" plane 2½" radius.....$12.50
90 degree twist 6" long.....$8.00
45 degree twist.....$8.00
40KW X BAND Radar, complete as described and illustrated in July 1951 PROC. IRE
APS-4 Under Belly Assembly, less tubes.....$375.00

1¼" x ⅝" WAVEGUIDE

Bi Dir-Coupler WG output calibrated—25 db nominal.....$17.50
Mitred Elbow H Plane UG51-UG52.....$12.00
6" St. sect. choke to choke.....$3.50
CG 98B/APQ 13 12" Flex. Sect. 1¼" x ⅝" OD.....$10.00
X BAND Wave GD. 1¼" x ⅝" OD, 1/16" wall aluminum.....per ft., 75¢
Slug Tuner Attenuator W.E. unit, Gold plated.....$6.50

1.25 CM RESEARCH EQUIPMENT

COMPLETE 24,000 MC RF HEAD, including 2K33 Klystron, 3J31 Magnetron and Magnet, all plumbing, and associated circuitry in standard A-N pressurized housing. New.....$1100.00
Low Power Load.....$20.00
Shunt Tee.....$35.00
Waveguide Lengths, 2" to 8" long, gold plated with circular flanges and coupling nuts.....per inch, $2.25
APS-34 Rotating Joint.....$49.50
Right Angle Bend E or H Plane, specify combination of couplings desired $12.00
45° Bend E or H Plane, choke to cover.....$12.00
Mitred Elbow, cover to cover.....$4.00
TR-ATR-Section, Choke to cover.....$4.00
Flexible Section 1" choke to choke.....$8.00
"S" Curve Choke to cover.....$4.50
Adapter, round to square.....$5.00
Feedback to Parabola Horn with pressurized window.....$27.50
90° Twist.....$10.00
"K" Band Directional Coupler.....each, $49.50

PULSE EQUIPMENT

MIT. MOD. 3 HARD TUBE PULSER: Output Pulse Power 144 KW (18 KV at 12 Amp.) Duty Ratio: .001 max. Pulse duration: .5, 1.0, 2.0 microsec. Input voltage: 115 v 400 to 2400 cps. Uses: 1-715B, 4-829-B, 3-72's, 1-73. New.....$110.00
APQ-13 PULSE MODULATOR. Pulse Width .5 to 1.1 Micro Sec. Rep. rate 624 to 1348 Pps. Pk. Pwr. cut 35 KW Energy 0.018 Joules.....$49.00
TPS-3 PULSE MODULATOR. Pk. power 50 amp. 24 KW (1200 KW pk): pulse rate 200 PPS, 1.5 microsec. pulse line impedance 50 ohms. Circuit series charging version of DC Resonance type. Uses two 705-A's as rectifiers. 115 v. 400 cycle input. New with all tubes.....$49.50
APS-IC MODULATOR DECK. Complete, less tubes.....$75.00

PULSE NETWORKS

15A—1-400-50: 15 KV, "A" CKT. 1 microsec 400 PPS, 50 ohms imp.*.....$42.50
G.E. #3E2-5-5000-501PFT. 6KV "E" circuit, 3 sections .5 microsecond, 5000 PPS, 50 ohms impedance.....$6.50
G.E. #3E (3-84-810) (8-2.24-405) 50P4T; 3KV "E" CKT Dual Unit: Unit 1, 3 sections, 84 Microsec. 810 PPS, 50 ohms imp.: Unit 2, 8 Sections, 2.24 microsec. 405 PPS. 50 ohms imp.....$6.50
7.5E3-1-200-67P. 7.5 KV, "E" Circuit, 1 microsec 200 PPS, 67 ohms impedance. 3 sections.....$7.50
7.5E4-16-60, 67P. 7.5 KV. "E" Circuit, 4 sections 16 microsec, 60 PPS, 67 ohms impedance.....$15.00
7.5E33-200-6FT, 7.5 KV, "E" Circuit, 3 microsec 200 PPS, 67 ohms imp. 3 sections.....$12.50

PULSE TRANSFORMERS

G.E.K.-2748.....$39.50
G.E.K.-2744-A. 11.5 KV High voltage, 5.3 KV Low Voltage @ 200 KW oper. (270 KW max.) 1 microsec. or 1/microsec. @ 600 PPS.....$39.50
W.E.-KS 9600 Input transformer. Winding ratio between terminals 3-5 and 1-2 is 1.1:1, and between terminals 6-7 and 1-2 is 2:1. Frequency range: 380-590 c.p.s. Permalloy core.....$8.00
W.E. #D169271 Hi Volt input pulse Transformer.....$27.50
G.E. K2450A. Will receive 13KV, 4 micro-second pulse on pri. secondary delivers 14KV Peak power out 100KW ea. G. E.....$34.50
G.E. K2748A. Pulse Input line to magnetron.....$35.00
Ray UX 7896—Pulse Output Pri. 5v, sec. 41v.....$7.50
Ray UX 8442—Pulse inversion—40v + 40v.....$7.50
Ray UX 7361.....$5.00
PHILCO #352-7250, 352-7251.
UTAH #9262, 5332, 9278.

MICROWAVE TEST EQUIPMENT

X BAND POWER METER

Consists of thermistor mount and bridge, microammeter, rough attenuator. X-Band Waveguide thruout. For power measurements anywhere in the 9000 MC band.

BROADBAND TEST OSCILLATOR

Freq. coverage 50-3000 MC. By direct calibration and interpolation anti-backlash gear drive; compact, portable. Operates from any 115V source or battery source. New, with all tubes.....$425.00

TS 56A/AP	I-158	TS 47/APR	TS 250/APN
CW60-ABM	I-222	TS 36/AP	TS 89
LU-1	I-185	TS 12 UNIT 2	I-203-A
LU-3		Q. METER	TS 11/AP
TS 159	TS 268/U	TS 69/AP	BC 438
CS60-ABW	TS 102/AP	TS 226	

SEND FOR FURTHER INFORMATION AND PRICES

RADAR INDICATORS

ID6/APN-4 LORAN INDICATOR Uses 5CP1. Includes all indicator circuitry and controls associated with Loran.....$75.00
BC 929 INDICATOR IFF indicator, uses 5BP1 with an 0-10/50/100 mile range. Includes lobe-switching motor, 8 tubes. New in original cases.....$75.00
R7BA/APS-15 Indicator console, 5FP7 PPI, 2AP1 "A" Scope. Includes receiver behind local oscillator. Uses 39 tubes, 3 meters—9 to 36 MC IF Strip.....$175.00
BC 931 INDICATOR Uses 5FP7, 4/20/50/100 Mile Range. "R" presentation includes remote amplifier with 2 tubes, linear potentiometer, mounting rack and visor.$58.00
ID-11/APQ-13 5" PPI, in used but good condition.....$45.00
SK-1M 12" (12GP7) PPI indicator console. Complete table ass'y, with all indicator circuitry and servomechanisms. New, in original export packed cases.....$375.00
SCR 535 IFF Set. Includes all parts:
1 each Radio Receiver BC-647-B
1 each Control Box BC-649-A
1 each 60amp. Fuse
2 each 15 amp. Fuse
2 each 28 volt lamp
1 each Instruction Book
Brand new.....$275.00

SO-7 RADAR

Complete surface search Truck-Portable 10 C. M. Radar with Plan Position Indicator. Operating from 115V-60 Cy. AC. Write for price and information.

RADAR SETS

APS-2, Airborne, 10 CM, Major Units, New
APS-4, Airborne, 3 CM, Compl.
APS-15, Airborne, 3 CM, Major Units, New
SD-4, Submarine, 200 MC, Compl., New
SF, Shipboard, 10 CM, Compl., New
SF-1, Shipboard, 10 CM, Compl., New
SJ-1, Submarine, 10 CM, Compl., Used
SL-1, Shipboard, 10 CM, Compl., Used
SN, Portable, 10 CM, Compl., Used
SQ, Portable, 10 CM, Compl. Used
SO-1, Shipboard, 10 CM, Compl. Used
SO-7, Portable, 10 CM, Assault
SO-8, Shipboard, 10 CM, Compl. Used

THERMISTORS

D-166283.....$1.50
D-167332 (tube).....$1.50
D-170396 (bead).....$1.50
D-167613 (button).....$1.50
D-164899 for WTG "X" band Guide.....$2.50

VARISTORS

D-167176.....$ .95
D-172155.....$2.25
D-172307.....$1.70
D-168627.....$ .95
D-171812.....$ .95
D-171528.....$ .95
D-162356(308A).....$1.50

MAGNETRONS

Tube	
2J27	2J62
2J31	3J31
2J21-A	5J39
2J22	718DY
2J26	720DY
2J32	725-A
2J39 Pkg.	738-A
2J39 Pkg.	QK 62
2J49	QK 59
2J61	QK 61
	QK 60

700 A, B, C, D
706 AY, BY, DY, EY, FY, GY

All merchandise guaranteed. All prices F.O.B. N.Y.C. Send M.O. or Check. Only shipping charges sent C.O.D. Rated concerns send P. O.

COMMUNICATIONS EQUIPMENT CO.

131 Liberty St., New York, N. Y. Dept. E-1 **Phone: Digby 9-4124**

CONDENSERS

and ELECTRONIC COMPONENTS—IMMEDIATE DELIVERY

OIL CONDENSER SPECIAL

10 mfd.—600 V.....$ .89

Three term, bat. mntg. channel type. Dims. 3¾" x 3½" x 2". Two 5 mfd. sections rated 400 V at 72 deg. "C". 1800 V test. Meets commercial specs. for 600 V. operation up to 40 degs. "C". Ideal for filter or power factor application where ruggedness and durability are paramount. Carton of 24, weight 42 lbs. ..... **$.79**

MFD	VOLTAGE	PRICE
.004-.905-.01	10 KV	$3.75
.012	25 KV	15.90
.02	20 KV	14.90
.075-.075	7.5 KV	7.90
.08	12.5 KV	10.90
.1	1500 V	.59
.1	2500 V	1.29
.1	3000 V	1.75
.1	7500 V	1.95
.1	7500 V	4.25
.1-.1	7500 V	6.25
.1	10 KV	8.95
.1	15KV	13.95
.1	25 KV	25.95
.15-.15	8000 V	1.95
.2	10 KV	10.95
.25	600 V	.37
.25	2000 V	1.25
.25	3000 V	2.25
.25	6000 V	1.75
.25	18 KV	15.95
.25	20 KV	19.95
.25	32.5 KV	31.95
.25	10 KV	12.95
.4	400 V	.25
.5	500 V	.41
.5	1000 V	.65
.5	1500 V	1.62
.5	2000 V	1.39
.5	3000 V	2.49
.5	25 KV	45.50
.5	2000 V	.85
.5-.1	600 V	.49
.5-.5	400 V	.45
1	500 V	.45
1	600 V	.65
1	1600 V	.69
1	1500 V	.97
1	2000 V	1.95
1	2500 V	2.25
1	3000 V	3.50
1	5000 V	4.65
1	6000 V	5.35
1	15 KV	25.95
1	20 KV	55.95
1	25 KV	69.95
2	600 V	.59-.79
2 TLA	600 V	.89
2	1000 V	.95-1.45
2 TLA	1000 V	1.49
2	1500 V	1.65
2	2000 V	2.90
2	2500 V	63.39
2	3000 V	4.69
2	4000 V	5.49
2	5000 V	18.95
2	12.5 KV	33.95
2-2	600 V	1.29
3	600 V	.59
3	4000 V	6.95
3-3	150 V	.25
3-3-3	400 V	.75
3.75	1000 V	1.59
4	400 V	.85
4	600 V	1.25
4 TLA	600 V	1.49
4 TLAD	600 V	1.55
4	1000 V	2.15
4	1500 V	2.69
4	2000 V	4.25
4	2500 V	4.95
4	3000 V	7.95
4	4000 V	9.95
4-4	1000 V	2.49
5	330 VAC	1.75
5	660 VAC	2.49
5	600 V	1.29
5	10 KV	41.50
5-5	400 V	.89
5-5	600 V	1.49
6	600 V	1.35
6	330 VAC	2.49
6	1000 V	2.49
6	1500 V	3.25
6	2000 V	3.95
7	600 V	1.45
7	800 V	1.95
7	1000 V	3.15
8	500 V	1.35
8	600 V	1.59
8	660 VAC	4.75
8	1000 V	1.55
8	2000 V	4.95
8-8	600	1.75
10	400 V	.99
10	600 V	1.29-2.50
10	1000 V	4.55
17 TLAD	25 V	.69
12	1000 V	4.85
15	1000 V	5.35
24	1500 V	9.50

BATHTUB CONDS.

MFD	Voltage	Price	MFD	Voltage	Price
.05-.05	600 V	.30	.3	400 V	.24
.1	600 V	.39	.5	400 V	.40
.1	1000 V	.45	.5	600 V	.32-.45
.1-.1	1000 V	.51	.5-.5	600 V	.58
.1-.1	600 V	.39	1	300 V	.30
.2	1000	.19	1	400 V	.48
.25	600 V	.41	1	600 V	.56
.25-.25	600 V	.45	2	400 V	.68
.25	1000 V	.45	2	600 V	.91

SPECIAL BATHTUB KIT.....15 @ $1.00

CHANNEL CONDS.

MFD	Volt	Price	MFD	Volt	Price
.05-.05	600 V	.38	.4	600 V	.39
.1	600 V	.4	.5	600 V	.49
.1	2500V	1.39			
.1-.1	400 V	.38	.5	400 V	.19
.1-.1	600 V	.41			
.1-.1-.1	400 V.	.41	1	500 V	.38
.25	600 V	.43	1	600 V	.45

MICA CONDENSERS

5, 6, 8, 10, 15, 25, 30, 34, 39, 50, 70, 75, 100, 140, 150, 185, 200, 230, 240, 250, 300, 350, 390, 400, 470, 500, 510, 600, 630, 700, 750, 1000, 1200, 1250, 1400, 1500, 2000, 2200, 2400, 3000, 3300, 3700, 3900, 4000, 4700, 5000, 5100, 6000, 6200, 6500, 7900, 7950, 7960, 8000 & 9100 mmfd.

PRICE SCHEDULE

5 to 750 mmfd.....5¢
2000 to 5700 mmfd.....15¢
1000 to 1500 mmfd.....7¢
6000 to 8000 mmfd.....12¢

Special Mica Kit—100 @ $3.50

SILVER MICA CONDENSERS

7, 24, 25, 33, 50, 60, 75, 95, 100, 120, 150, 170, 200, 270, 300, 330, 390, 400, 450, 500, 750, 800, 1000, 1400, 1450, 1700, & 2500 mmfd.

PRICE SCHEDULE

7 to 95 mmfd.....9¢
1000 to 1700 mmfd.....14¢
100 to 820 mmfd.....9¢
2500 mmfd.....16¢

SPECIAL S.MICA KIT-100 @ $6.50

CERAMICON CONDS.

10, 56 & 100 mmfd @.....8¢
1000 to 5000 mmfd @.....8¢

MOLDED PAPER CONDS.

(W.E.)

.01 400 V Type CN 25 .03 ea. $ 7.50 per "C"
.01, .05, .05 400 V. 25 ea. $ 3.50 per "C"
.004, .01, .03 600 V. 25 ea. $ 4.50 per "C"
.1 1000 V. 25 ea. $ 7.50 per "C"
.01 1000 V. 125 ea. $11.50 per "C"

COAX CONNECTORS

83—1R	.50	83—1T	$1.10
83—1AP	.22	83—1SP	.52
83—1J	.69	83—1SPN	.52

Coax assembly RG—59/U-6' in length, connected with 83 1SPN, 83—1J and Amphenol 21-M Connector. $ .89. Less 83-1J $ .32.

TYPE "AB" POTS

$1.35

OHMS	Shaft
50	1/8 S
60	1/8 LS
150	1/4 S
300	3/8 S
500	3/8 & 1/8 S
1000	1/8 S
1500	1/4 S
2000	1/8 LS & 1/8S
2500	1/8 S
5000	1/8 LS
6000	1/4
5000	1/8 LS & 1/8
10000	3/8 & 1 1/7
10000	5/16
15000	1/8 S
20000	1 1/4 & 1/8 LS
25000	3/8 & 1/8 S
30000	1/8 S
40000	1/8 LS
50000	1/4 & 1/8 S
50000	1/8 LS
100000	1/2"
150000	2 1/8
200000	1/8 LS
250000	1/8 LS, 9/16 & 1/8 S
500000	1/8 S
(2 turns.)	
1 Meg.	1/8 S & 1/8 LS

DUAL "AB" POTS—$2.75

OHMS	SHAFT	OHMS	SHAFT
1500	5/16"	20K	7/16"
1-5 meg	1/2"	1 meg	1/2"
		2 meg	1/8 S

New Toggle Sws. Jan Style

Type	Jan	Price	Jan	Price
DPST	ST52K	.82	ST50K	.98
DPDT	ST52N	.94	ST50N	1.03
DPDT	ST52P	.94	ST50P	1.03
DPST	ST52M	.99	ST50M	1.08

All SWS. 15A, 125 VAC; 10A. 250 VAC To Jan-S-23 Spec. Qua. Discounts.

Toggle Sw. Special

DPST	AH&H 3/8" bushing, Bat Hand.	$.55
DPDT	AH&H 1" bushing, Bat Hand.	.59
DPDT	C-H #8824 K 7/16" bushing Bat. Hand.	.78
5PST	C-H #8800 K 7/16" bushing Bat Hand.	.69
5PST	3A. 250 VAC 3/8" bushing	.59

TRANS. MICA CONDS.

MFD	WVDC	Price	MFD	WVDC	Price
.01	600 V	.33	.0003	6000 V	.39
.01	1200 V	.55	.004	2500 V	.48
.0125	6000 V	7.50	.005	1200 V	.48
.02	2000 V	.50	.0001	5000 V	.69
.03	600 V	.49	.0002	5000 V	1.19
.001	5000 V	1.49	.00025	1200 V	.39
.001	2500 V	.49	.0005	5000 V	1.39
.0024	5000 V	1.55			

RELAYS

3PST Stern Duna # 1CXX 100
DPDT Stern Duna # 1XXX 103
115 V. 6A. Conts.....$2.00
115 V. 6A. Conts.....$2.30

NEW BC 906 FREQ. METER

Range 150-225 MC—Bat. operation with precision velvet vernier dial, tuning charts, 0-500 D.C. microammeter, diode-Triode and plug-in antenna. Contained in black aluminum carrying case 12½ x 8¾ x 6½. Price **$18.95**

New—Tubes—Boxes

2C-26.....	.89	832 A.....	9.25
954.....	.79	838.....	1.35
1616.....	1.35	872 A.....	1.95
9004.....	.45	12C8.....	.89
1B29.....	1.25	2J39.....	35.00

25 WATT POWER RHEOSTATS

Ohms	Shaft	Price	Ohms	Shaft	Price
1.3-1.3	1/8 S	1.89	225	1/4 S	.89
15	1/2	.79	225	1/8 LS	.89
20	1/2	.79	300	1/2	.89
25	1/2	.79	500	1/4 S	.89
50	1/8 S	.79	500	1/8 S	.89
50-50	1/2	1.59	1500	1/2 S	.89
75	1.0	.79	2000	3/8	.89
100	1/2	.79	2500	1/2	1.25
125	1/2 S	.89	5000	1/8 S	1.15
175	1/2	.89	5000	1/2	1.15

100 ohm type Lots of 100....54¢

MONMOUTH RADIO LABORATORIES

BOX 139 — Long Branch 6-5192 — OAKHURST, N.J.

DYNAMOTORS

Type	Input Volts	Input Amps.	Output Volts	Output Amps.	Radio Set
PE86	28	1.25	250	.060	RCM
DM416	12	4.2	110	.170	RU 19
DM33A	28	7	540	.250	BC 458
PE101C	13/26	12.5	400	.115	SCR 515
		6.5	800	.025	
RD AR 93	28	3.25	375	.150	
23100	27	1.75	285	.075	APN-1
ZA0515	12/24	6/3	500	.050	
B-19 pack	12	9.4	275	.110	MARK II
			250	.150	
D-104	12		225	.180	
			440	.205	
DA-3A	28	10	300	.060	SCR 522
			150	.010	
			14.5	.5	
5053	28	1.4	250	.060	APN-1
PC71CM	28	15	1200	.350	BC 375
CW21AAX	13	12.6	4000	.135	
	26	6.3	800	.020	
			9	1.12	
PE94	28	10	300	.200	SCR 522
			150	.101	
			14.5	.5	

INVERTERS

PE-218-E: Input: 23 28 vdc, 92 amp. Output: 115 v. 350-500 cy 1500 volt-amperes. Dim. 17"x6½"x10". New $49.50

PE-218-H: Same as above except size: 16½"x8"x10". New $49.50

PE206: Input: 28 vdc, 38 amps. Output: 80 v 800 cy, 500 volt-amps. Dim: 13"x5½"x10½" $22.50

PRECISION RESISTORS

OHMS	OHMS	OHMS
5	150	7,500
5.05	250	10,000
10	450	12,000
18	468	17,000
82	900	25,000
120	920	30,000
125	1100	35,000
128	4300	54,000
30c each ..... 10 for $2.50		
100K	120K	150K	220K
40¢ each ..... 10 for $3.50		

1 Megohm ..... each .75¢

B-19 MK II TRANSRECEIVER
Less Power Pack..$32.50
B-19 Power Pack.. 8.95

ARC5 MODULATOR
MDT/ARC5
Plate Modulator w/dynamotor complete w/Tubes 1 — 1625, 3 — 1635, 1 — VR50. Good cond.
Price $6.95

ID-24 ARN-9
Dual 0-300 Microamp. Movement in 3" Case. ILS Equipment $9.95

AUDIO TRANSFORMERS

AT501 HI-FI Special: PRI: 3000 ohms P-P/Sec: 4/16/12/50/200 ohms 60-10,000 CY.—1 db 50W as shown $3.49

AT102 HI-FI Driver Pri: 10,000 ohms Sec: 40,000 ohms PP Grids 50-15 KC/1 db $1.49

AT053 Output to H.S. or line PRI: 14,200 ohms SEC: 8000/600 ohms $1.10

AT449 HI-FI Driver (5000 ohms) to P.P. output grids (4,000 ohms) 100-10,000 CY. 10 W. 6V6 to PP 5Y5's $2.38

AT986 Intercom Input: Spkr (4-8 ohms) to grid (250,000 ohms) $0.69

AT415 Plate (18,000 ohms C.T.) to line (125 ohms) 175 w.—500-600 CY. $1.95

AT838 Plate (10,000 ohms C.T.) to line V.C. (500/125/30 ohms) HI-FI—50 W $6.95

AT070 Mike-or-Line (250 ohms) to grid (250,000 ohms C.T.) $1.29

AT705 Mike-or-Line (600 ohms) to grid (50,000 ohms C.T.) $0.89

MOBILE MODULATION KITS

T-103 Mike to 6J5 grid.
T-102 6J5 to Modulators, PP 6V6 or PP 6L6.
T-104 Mod. Trans. PP 6V6 or PP 6L6 to 829, 833, or 2E26. All components miniature, ruggedized, and hermetically sealed. COMLETE KIT & DIAGRAM $3.50

UNIVERSAL POWER TRANSFORMER
Pri: Vibrator Input @ 6/12/24/110VDC
AC Input: 110/220V, @ 60 CY.
Sec: 320-0-320V — 40MA, 6.3V — 1.8A
Es..... $1.49

HI-FI UNIVERSAL OUTPUT TRANSFORMER
Amertran Silcor. PRI: 20,000/16, 000 / 5000 / 4000 ohms. Sect. 500/15 / 7.5 / 5 / 3.75 /1.25 ohms. 30 db. contin. Flat to 20,000 CY.
w/Diag $4.75

FILTER CHOKES

Stock	Description	Price
CH-250	SWING. 2.5-24H/4-85A 10KV Test	$7.95
CH-8-19	SWING. .006H/5A-.038H/5A .032 ohms DCR, 1KV TEST	3.95
CH-776	1.2H 110 MA/75 ohms	2.25
CH-344	1.5 H/145 MA/1200V Test	2.35
CH-854	1 HY/80 MA	1.29
CH-412A	10 HY/15 MA—650 ohms DCR	1.75
CH-999	15 HY/15 MA—400 ohms DCR	1.95
CH-511	6 H/80 MA—310 ohms DCR	2.45
CH7-501	2x.5H/400 MA	2.79
CH-1850M	5 HY 200 MA	1.79
CH-488	10 HY .030A	1.19
CH-781	Dual 1.75-.125 HY 100 MA	1.27

ANNOUNCING...

Our New New Ham Dept. Featuring:—

SONAR MOBILE MB-26 Xmtr

Like SR-9 Rcvr, this crystal-controlled 6-tube Xmtr goes everywhere, fits anywhere, employs latest v.h.f. techniques! Lets you send clear signal, no matter how grueling the going. Output: 6 watts. Power consumption: equivalent to car bright lights. Just 6½" high, 7" wide, 5⅝" deep. Built-in antenna relay system, power filter network. Low maintenance — standard tubes. Power and antenna coax connectors on front panel.

8 or 24 Mc. crystal, overtone type. Screwdriver adjusted tuning control.

$72.45

SONAR MOBILE SR-9 Rcvr

Your choice of 2, 6, 10 meters and commercial frequencies, AM and FM.

$72.45

Indispensable when you must hear what's coming through in mobile or fixed operation. CD, CAP or emergency activity. More than a monitor, more than a converter—it's a 9-tube superhet receiver with over-all sensitivity better than 1.0 micro-volt. Tiny—only 4-9/16" high, 5-3/16" wide, and 5-11/16" deep. Yet SR- 9 gives you built-in automatic noise limiter, voltage regulated oscillator, precision slide rule dial.

FULL WAVE BRIDGE SELENIUM RECTIFIERS

Up to 12v. RMS a.c. input—Up to 14v. d.c. output

Max. d.c. amps.	Price
2	$2.50
4	4.00
6	6.00
10	7.50
12	8.00
20	13.00
24	15.00
30	22.00
36	27.00

Up to 28v. RMS a.c. input—Up to 28v. d.c. output

1	3.00
2	4.00
4	6.00
10	14.50
12	18.00
20	28.00
24	34.00
30	42.00
36	54.00

Up to 54v. RMS a.c. input—Up to 42v. d.c. output

2	6.50
4	8.50

Up to 115 v. RMS a.c. input—Up to 100v. d.c. output

2	11.00
10	42.50
12	49.00

SPECIAL RECTIFIERS ON REQUEST

Low-Voltage Transformers Primaries 115v., 60 Cycle

36V-40V at 3.5 amps	$3.75
24V-1.5A	1.95
6V-1.5A	.98
16V-4.5A	3.75

HI CAP. FILTER CONDENSERS

Cap. Mfd.	WVDC	Price
800	15	$1.25
2000	6	1.25
500	200	2.00
250	150	1.45

A.C. ELECTROLYTICS

CAP.	VAC.	PRICE
12-15	220-	$1.20
29-34	110-	1.00
36-38	220-	1.35
43-48	110-	1.25
43-48	110-	1.25
50-75	110-	1.25
53-60	220-	1.50
61-69	220-	1.50
64-72	110-	1.25
72-87	110-	1.25
75-84	110-	1.25
88-106	110-	1.50
107-129	110-	1.45
134-157	110-	1.75
134-154	70-	1.50
138-168	110-	1.85
168-191	110-	1.95
168-189	110-	1.75
189-210	110-	1.95
200-229	110-	1.95
270-300	110-	2.10
270-300	110-	2.10
378-429	175-	3.00
432-480	110-	2.75
485-540	110-	2.85

OIL CONDENSERS

Mfd.	Volt.	Price
.5	50	$0.45
650	50	1.95
15	220 AC	2.20
8	750 AC	1.50
.05	1000	.69
2x0.5	1000	.70
1	1000	.75
1.5	1000	.85
2	1000	.90
4	1000	1.75
3x.01	1200	1.35
1	1500	1.30
1.5	1500	1.40
2	1500	1.45
0.15	4000	1.20
2x0.1	4000	1.20
0.1	6000	2.30
1.5	6000	17.50
2x0.1	7000	2.95
.015	16000	3.95
.0016	18000	6.95
.25	20000	
1	25000	
.5	25000	
1	7500	

MANY OTHERS

POWER TRANSFORMERS

Comb. Transformers—115V/50-60 cps input.

CT 77B	5500V/.002A, 2.5V/2A 12KV TEST			$12.95
	6.3VCT/6A—4000V TEST			
CT 75B	1300VCT/600MA, 2X5VCT/6.2A 6.3VCT/3A, 6.3V/3A			14.95
CT-825	360VCT	.340	6.3VCT/3.6, 6.3VCT/3A	3.95
CT-626	1500V	.160	2.5/12, 30/.160	9.95
CT-15A	350VCT	.070	6.3/.6, 6.3/1.8, 3 lbs.	2.95
CT-871	110V	.200	35/.200, 5V/10, 2.5/10	4.95
CT-378	2300V	4 MA	2.5/5	6.95
CT-367	580VCT	.050	5VCT/3A	2.25
CT-731	550VCT	.100	6.3/1, 2.5VCT/3	2.95
CT-99A	2x110VCT	.010	6.3/1A, 2.5VCT/7A	3.25
CT-463	350VCT	.026 MA	5V/3A	2.75
CT-931	580VCT	.036	5V/3A, 6.3V/6A	4.25
CT-610	1200	.092 MA	2.5V/2.1A, 2.5V/1.75A	4.95
CT-137	350VCT	.026 MA	5V/3A	2.75
CT-866	330V	.045	6.3V/1.2, 6.3V/600 MA	1.75
CT-456	390VCT	30 MA	6.3V/1.3A, 5V/3A	3.45
CT-160	800VCT	100 MA	6.3V/1.2A, 5V/3A	4.95
CT-319	660VCT	.008A	5V/2A, 6.3/7.5A, 6.3/3A	3.25
CT-931	580VCT	86 MA	5V/3A, 6.3V/6A	4.95
CT-442	535VCT	75 MA	5V/2A, 10VCT/2A, 60V/200 MA	3.85

Filament Transformers—115V/50-60 cps input.

Item	Rating	Each
FT-781	866 Trans. 2x2.5/2A	$2.25
FTG-31	2.5V/2.5, 7V/7A (Tape @ 2.5V/2.5A), 16 lbs.	9.95
FT-674	8.1V/1.5A	1.19
FT-157	4V/16A, 2.5V/1.75A	2.35
FT-101	6V/.25A	.79
FT-924	5.25V/21A, 2x7.75V/6.5A	17.95
FT-104	6V/.5A	4.79
FT-824	2x26V/2.5A, 16V/1A, 7.2V/7A, 6.4V/10A, 6.4V/2A	12.95
FT-463	6.3VCT/1A, 5VCT/3A, 5VCT/3A	5.49
FT 55-2	7.2V/21.5A, 6.5V/6.85A, 5V/6A, 5V/3A	8.95
FT 906	16V @ 4.5A or 12V @ 4.5A	3.75
FT 38A	6.3/2.5A, 2 x 2.5V/7A	4.75
FT A37	2.5V/2.5A, 7V/7A TAP 2.5V/2.5A 16KV TEST	12.95
FT 360	2 x 2.5V/3A, 7V/7A—23KV TEST	24.95
FT 038	6.3V/500A WELD	29.45

Plate Transformers—115V/50-60 cps input.

Item	Rating	Each
PT-910	1200-0-1200, 200 MA	$8.95
PT-976	Auto: 1280VCT/10 MA	.89
PT-31A	2x300V/5 MA	.79
PT-46A	4000VCT N.L. 3½ to 18" Hgt Watt L. 20 lbs.	29.95
PT-75-2	3780/3446/3112VCT/77 MA	10.95
PT-28-1	4600VCT/.077	12.95
PT-405	Auto: 70V/1A	4.95
PT-1660	1120VCT/770 MA, 590VCT/82 MA, 25 lbs.	34.95
PT-170	Auto: 156/146/137/128—.71A	3.29
PT-31A	2x300V/5 MA	.79
PT-976	1280VCT/10MA	.89
PT-12A	280VCT/1.3A	2.95
PT-614	4730VCT/500MA 12KV INS	29.95

Special Filament Transformers

Item	Pri.	Output	Price
STF-638	230	5V/9A 5½" H x 4½" x 3⅝"	$1.25
STF-05A	115/230	2 x 5V/7.5" H x 7" x 5" D.	4.35
STF-685	220	30-25-20V/1 MA	.89
STF-968	220	2.5V/6.5A	1.49
STF-370	220/440	3 x 2.5V/5V, 2.5V/15A, 5½ x 7 x 4½	5.29
STF-11A	220	2 x 40V/.05/2 x 5V/6A, 12.6/1A	3.95
STF-631	230	2 x 5V/27A, 2 x 6V/9A, 100/4A, 3 x 7 30 lbs.	24.90
STF-96B	230	2.5/6.5A	1.95
STF-570	220/440V	3 x 2.5V/5A, 2.5V/15A	3.95
STF-695	220/440V	2.5V/6V 6C ACT	18.50
STF-983	220/440V	5VCT/30A, 3000V TEST	17.50

115 V—400 CY XFMRS

Stock #	Ratings	Price
901699-501	2.77V @ 4.25A	$3.45
901658-501	900V/75 MA, 100V/.04A	4.29
UXB855C	900VCT/.067A, 5V/3A	3.77
RA6485-1	800VCT/65MA, 5VCT/3A	3.89
T-48852	700VCT/80 MA, 5V/3A, 6V/1.75A	4.25
352-7098	2500V/63MA 300VCT/135 MA	5.98
KS 9336	1100V/50MA TAPPED 625V 2.5V/6A	3.98
M-7474319	6.3V/2.7A, 6.3V/.66A, 6.3VCT/21A	4.39
KS 9984	27V/4.5A, 6.3V/2.9A, 2.25V/.02A	2.98
52C988	525VCT/50MA, 6.3VCT/2A, 5VCT/2A	3.75
32332	460VCT/35MA, 6.4V/2.5A, 6.4V/15A	3.98
54G431	1150-0-1150V	2.75
50G196	6VCT, 00006 KVA	1.75
D-167254	6.4V/8A, 6.4V/1A	2.79
382433-A	6.3V/9.1A, 6.3VCT/6.5A, 2.5V/3.5A, 2.5V/3.5A	4.85
KS 9445	592VCT/118MA, 6.3V/8.1A, 5V/2A	5.39
KS 9685	6.4V/7.5A, 6.4V/3.8A, 6.4V/2.5A ALL CT	4.79
79G39G1	600 VCT/36 MA	2.45
M-7474318	2100V/.027A	4.95
95-G-45	2800V/.080V/NL 465V/.6A, 44V/10A, 6.3V/23.5A, 6.3V/1.8A, 5V/9A, 2X3.5V/1.75A	17.95

All merchandise guaranteed. All prices F. O. B. N.Y.C. Send M. O. or Check. Only shipping charges sent C.O.D. Rated concerns send P. O.

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131 Liberty St., New York, N. Y. Dept. E-1 Chas. Rosen Phone: Digby 9-4124

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"An" Connectors, Large Variety in Stock at Tremendous Savings Quotation Requests Invited.

HEART OF THE BC-221 FREQ. METER

This VFO Sub-Assembly, used in BC-221 Freq. Meter, FULLY WIRED and mounted on sturdy aluminum sub-chassis, ready for installation. Brand new—in original packing. Very special.

EACH **$4.50**

BRAND NEW HEINEMANN CIRCUIT BREAKERS

Amps	Volts	Part No.	
7	24 D.C.	AM1510M-7	
10	40 D.C.	P-0322	1.49 Each
.220	24 D.C.	PAM-1510RWM0220	
.010	24 D.C.	B-20C-2826	
40	24 D.C.	AM1510RWM-40	
7.5	24 D.C.	T-128	2.49 Each
8-25	230 A.C. (Dual)	0322	

FAMOUS MAKE SELENIUM RECTIFIERS

All first quality, guaranteed brand new fresh factory stock. Buy now while still available. All 130 V.

D.C. MA.	SINGLY EACH	LOTS OF EACH
65	.66	.63
75	.78	.75
100	.96	.92
150	1.17	1.10
200	1.35	1.27
250	1.50	1.48
275	1.65	1.55
300	1.89	1.75
350	2.15	2.01
400	2.54	2.43
450	2.64	2.52

Special Application. Stocks Made To Your Specs. Write for Quotation.

"CIF" TYPE FERRULE RESISTORS LARGE SELECTION AT LOW PRICES. SEND US YOUR QUOTATION REQUEST TODAY!

NEW V.T.V.M.

By DELTA

Model 10A

The most versatile test instrument offered to the electronic industry in years. A superb instrument, designed by engineers with years of "know-how". Intended for use in laboratories where precision is of paramount importance. Ruggedly built for dependable use on production line or general servicing.

- 28 Non-skip resistance and voltage ranges.
- Negative feed-back and patented bridge circuit for high stability.
- Measures R.M.S. and peak to peak voltages of complex wave forms.
- Zero center for discriminator and bias indications and any galvanometer applications.
- 250 Mc. coverage with the probes FURNISHED (At no extra charge).
- High-impedance frequency compensated attenuator.
- Automatic differentiation between A.C. and D.C. allowing A.C. to be read with a D.C. component and vice versa.

MODEL 10A DELTA V.T.V.M. with all probes and leads. Further information available upon application **$69.95**

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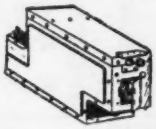
Niagara can supply your entire requirements in the electronic field. We are large scale suppliers of tubes, parts and equipment. Our large adequate inventory of standard lines of merchandise as well as surplus materials, enables us to serve you promptly.

You are invited to send us your quotation requests. Urgent orders will be shipped immediately upon receipt of order via phone, mail or wire.

Please address all inquiries to;

Mr. J. J. Garrettson
Industrial and Wholesale Div.

ARC-5/R-28 RECEIVER 100—156 Mcs.



New or used

Here is the aircraft superhet you have been looking for. Absolutely one of the best available today. Tunes from 100 to 156 mcs. in four crystal channels. Accurately calibrated dial on front panel. Contains the following tubes: 717a—R.F., 717a—Mixer, 2—12SH7—1st and 2nd I.F. (16.9 mc.), 12SL7—Det., AVC, Squelch, 12SL7—1st audio and squelch amplifier, 12A6—2nd audio, 12SH7—R.F. Osc. and 4th harmonic gen., 717a—trip. 12th Harmonic gen., 717a—Dblr. 24th Harmonic gen. (all tubes are included.)

New, in sealed cartons $24.95
Used, excellent condition $20.95

T23/ARC-5 TRANSMITTER

FAMOUS AIRCRAFT TRANSMITTER. COMPANION TO ABOVE RECEIVER.

A desirable VHF transmitter with turret switching coils for all stages. Uses the following tubes; 1625 Osc., 1625 Tripler, 832 Tripler, 832 Final amplifier. Range; 100 to 156 Mcs. Four crystal channels are provided.

Brand new with all tubes, less crystals $39.95

SPECIAL! FREE! with purchase of either of above two items, one copy of Volume 2 "Surplus Radio Conversion Manual" (Reg. price $2.50). This book contains full information and circuit diagrams of both the ARC 5/R-28 receiver and T23/ARC-5 transmitter.

SYNCHRO-SELSYNS

all brand new

Machine aluminum housing and case. Bakelite end cap with coded screw terminals. ¼" shaft.

C-78249 Cal. 11280 Synchro Differential 100 V. 60 Cycle. Price..... $3.75

C-78473 Cal. 13920 Repeater type XX 50 V. 50 Cycle. Price..... 3.75

C-78411 Cal. 11925 Transmitter 50 V. 50 Cycle. Price..... 3.75

The below listed type is similar to above, but contained in a solid machined bronze housing. 5 leads 5 ft. long, of color coded fiber glass insulation are provided.

C-56776-1 Ca-4460A-4 Repeater type 11-5 110 V. 50 Cycle. Price..... $7.50

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Niagara RADIO SUPPLY CORP. Dept.

Digby 9-1132-3-4

160 Greenwich Street, New York 6, N. Y.

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TIMING MOTOR
8 RPM 115V 60 cyc
E. Ingraham Co.

$1.95

GEAR ASSORTMENT
100 small assorted gears. Most are stainless steel or brass. Experimenters dream!.....Only $2.50

VERNIER DIAL or DRUM (From BC-221)
DIAL—3½" dia. 6-100 in 360°. Black with silver marks. Flat thumblock. DRUM—0-50 in 180°. Black with silver marks.....either 85¢

SOUND POWER HANDSET
Brand New!
Includes 6 ft. cord.—No batteries or external power source used. $17.00 pr.

Sound Powered Chest Set With 24 Ft. Cord

Variac—General Radio 100W removed from equipment
$10.00

400 CYCLE INVERTERS
Leeland Electric Co.
#16800 In: 25-28 V.D.C., 92 A. 8000 R.P.M. Out: 115V. 380-500 Cyc. 1 phase, 1500 V.A. 90 PF.....$24.95

3AG FUSES

AMP	Per 100	AMP	Per 100	AMP	Per 100
½	$4.00	¾	$4.00	6	$3.00
¼	4.00	1	3.00	10	3.00
½	4.00	5	3.00	15	3.00

DELAY NETWORK—ALL 1400Ω
T 114—Approx. 3.2 micro sec. delay..... $.95¢
T 115 Similar to T 114 with tap brought out..... each

BEARINGS

Mfg. No.	ID	OD	Thickness	Price
MRC3828-1	5 1/2	6 1/2"	1"	$3.50
MRC7935-1	5 5/64	6 15/64	9/16	2.50
Timken 37625	4 6/16	6 1/4	29/32	4.25
MRC-7921-200	4 1/8	5 9/32	23/64	2.45
Norma A 545	2 1/16	2 5/8	1/4"	1.00
MRC 106 M2	1 17/64	2 7/16	25/64	1.75
MRC 106 M1	1 13/64	2 7/16	25/64	1.60
Federal L8 11	1 1/8	2 1/2	5/8	1.75
Norma S 11 R	1 1/8	2 1/2	5/8	1.25
Fafnir B 541	1 1/16	1 1/2	9/32	.35
Hoover 7203	5/8	1 9/16	7/16	.90
Norma 203 S	5/8	1 9/16	7/16	.90
SCHATZ ...	3/4	1 3/4	9/16	1.00
NH 8202-C13M	1/2	1 3/8	1 3/8	1.00
ND 3200	25/64	1 5/32	11/32	.50
Norma 5 3R	3/8	7/8	7/32	.45
MRC 39 R1	11/32	1 1/32	6/16	.35
NDCW 6668	6/16	6/16	13/32	.45
MRC 38 R3	6/16	55/64	9/32	.45

NEEDLE BEARINGS
TORRINGTON B108 ½" wide ¾" 13/16" 35¢

Brand New METERS—Guaranteed
0-10 ma. D.C. 2½"... $.95 | 0-50 Amp. D.C. 2½"..$2.25

SELENIUM RECTIFIERS
Full Wave 200 MA 115V.....$1.79
Half Wave 100 MA 115V......91

SPAGHETTI SLEEVING—assortment—99 feet.....$1.00

TYPE "J" POTENTIOMETERS

50	SD	1500	SD	5000	3/8"	70K	SD
100	SD	2000	SD	10K	3/8"	80K	SD
150	SD	2000	SD*	10K	SD*	100K	3/8
300	SD	2000	3/8	15K	1/4"	200K	SD*
400	3/8	2500	1/2"	15K	SD*	200K	3/8
500	3/8	2500	SD	15K	3/8"	250K	SD*
1000	SD*	3000	3/8	25K	SD*	250K	3/8*
1000	3/8	4000	3/8	50K	SD*	1 Meg	SD

*Split locking bushing $1.50 each

JONES BARRIER STRIPS

Type	Price	Type	Price	Type	Price	Type	Price
2-140Y	$0.13	5-141W	$0.24	9-141W	$0.64	3-142	.21
3-140¾W	.19	5-141Y	.26	9-141Y	.64	5-142	.22
5-140	.25	5-141¾W	.37	7-142	.42	12-142	.72
10-140¾W	.53	7-141	.34	3-142	.21	2-150	.39
3-141¾W	.24	5-141¾W	.49	12-142	.72	3-150	.54
3-141W	.24	10-140W	.53	2-150	.39		

TIME DELAY RELAY

Eagle Signal Corp., Moline, Illinois
115 V., 60 Cycle
2½ second recycling time—spring return • Micro-switch contact, 10A • Holds ON as long as power is applied • Fully Cased •
ONLY.....$6.50

AN CONNECTORS
IMMEDIATE SERVICE
PHONE! WIRE! WRITE! YOUR NEEDS

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	Price per 1,000 Ft.		Price per 1,000 Ft.
RG 7/U	$85.00	RG 29/U	50.00
RG 8/U	150.00	RG 41/U	295.00
RG 9/U	200.00	RG 55/U	85.00
RG 10/U	245.00	RG 57/U	125.00
RG 11/U	150.00	RG 58/U	70.00
RG 22/U	150.00	RG 59/U	70.00
RG 23/U	175.00	RG 62/U	100.00
RG 34/U	125.00	RG 77/U	100.00

Add 25% for orders less than 1,000 feet.
No minimum order—others $50 minimum.

COAXIAL CABLE CONNECTORS

15¢ UG 175/U	$1.30 83-1F	30¢ ANGLE	80¢ 83-1J	40¢ 83-1R	10¢ HOOD
83-1AC	$0.42	83-22AP	$1.10	UG 57/U	$2.30
83-1AP	.36	83-22R	.48	UG 58/U	.43
83-1F	1.30	83-22SP	1.15	UG 60/U	2.40
83-1H	.10	UG 13/U	1.75	UG 85/U	1.75
83-1J	.80	UG 21/U	1.20	UG 87/U	1.60
83-1R	.40	UG 21B/U	1.45	UG 88/U	1.60
83-1SP	.40	UG 23B/U	1.65	UG 167/U	2.95
83-1SPN	.40	UG 22/U	1.30	UG 175/U	.15
83-16S	.15	UG 24/U	1.30	UG 176/U	.15
83-18S	.15	UG 25/U	1.25	UG 206/U	1.60
83-2AP	2.00	UG 27/U	1.30	UG 260/U	1.60
83-2R	1.30	UG 30/U	2.50	UG 499/U	1.25
UG 255	2.45	UG 59A/U	2.25		
UG 224/U	1.40	UG 306/U	2.95		

DIFFERENTIAL
115 V., 60 Cyc. **$3.95** ea.
#C78249

3½" dia. x 5½" long
Used between two #C7824's as dampener. Can be converted to 3600 RPM Motor in 10 minutes. Conversion sheet supplied. (Converted).....$4.50
Mounting Brackets — Bakelite for selsyns, and differentials shown above.....35¢ pair

2J1G1 SELSYNS
BRAND NEW 400 CYCLE

POSTAGE STAMP MICAS

mmf	mmf	mmf	mmf	mmf	mmf	mmf	mfd	mfd	mfd
7	33	50	82	180	470	800	.001635	.0044	
7.5	34	51	90	220	500	820	.002	.0056	
8	35	56	100	240	510	910	.0027	.0062	
8.2	36	60	110	250	560	.001	.003	.0065	
10	39	62	120	260	580	.0011	.0033	.0068	
15	39	68	125	350	600	.0012	.0035	.0082	
18	40	70	150	390	650	.0013	.0036	.01	
20	43	75	160	400	680	.00136	.0039		
22	47	80	175	430	750	.0015	.004		

Price Schedule

8.2 mmf to 910 mmf.....5¢
.001 mfd to 001638.....5¢
.002 mfd to .0082 mfd.....15¢
.01 mfd.....25¢

SILVER MICAS

mmf	mmf	mmf	mmf	mmf	mmf	mmf	mfd	mfd
.8	39	75	150	270	430	700	.0028	.005
10	40	82	155	275	455	800	.0027	.0051
18	47	100	170	325	470	875	.00282	.0056
20	50	110	180	350	500	.0011	.002826	.006
22	51	115	208	360	510	.0013	.003	.0068
23	60	120	225	370	525	.0015	.0033	.0082
24	62	125	240	390	550	.0016	.0035	
27	66	130	250	400	570	.0022	.0039	
30	68	135	260	410	680	.0023	.004	

Price Schedule

10 mmf to 900 mmf.....10¢
.0011 mfd to .0023 mfd.....20¢
.0026 mfd to .0082 mfd.....30¢

PULSE TRANSFORMERS

UTAH—9278 9262 9280
WESTERN ELECTRIC—D168173 D161310
KS8696, KS9365, KS9565, KS9890, KS8965, KS13161
GENERAL ELECTRIC—K2731 80-G-5
JEFFERSON ELECTRIC—C-12A-1318
DINION COIL—TR1048 TR1049
also 352-7250-2A; 352-7251-2A; T-1-229631-60

PRECISION RESISTORS—¼ WATT—30¢

2	10.48	13.32	14.98	82.84	147.5	704
2.5	10.54	13.03	15.3	79.51	226.8	2,199
3.5	11.35	13.93	16.37	146.5	301.6	3,800
5	11.74	13.89	25	153.5	295.6	50,148
6.66				135	414.5	88,148

PRECISION RESISTORS—½ WATT—35¢

.25	15	87	389	3,986	12,000	33,000
.334	15.75	97.8	392	4,000	14,525	35,000
.444	28	128	400	4,161	15,000	52,000
.502	34.75	147.5	725.1	4,365	15,750	39,000
.557	44.78	148.7	855	4,500	15,795	37,000
.627	45	178	970	4,642	15,810	41,000
1	46	179.5	1,100	5,788	16,000	48,000
2.04	49	180	1,394	6,714	16,700	47,000
2.25	52	210	1,878	6,900	17,000	56,000
3.7	55.1	220	1,400	6,900	19,800	50,000
3.24	60	235	1,490	7,000	20,150	59,000
3.36	61	240	1,800	7,500	21,800	58,000
5.89	65	280	2,250	8,000	25,000	68,000
10.55	66	270	2,500	8,500	26,967	70,000
11.1	66.6	295	3,000	8,800	32,000	79,013
13.16	69	298	3,400	9,000	32,700	106,000
13.3	75	298.3	3,437	10,000	33,888	150,000

PRECISION RESISTORS—1 WATT—45¢

.1	2.55	15	71	2,320	8,000	45,000
.11	2.56	16	80	2,415	8,250	48,000
.2	2.67	27.4	200	2,500	9,000	50,000
.31	2.69	70	250	3,000	10,000	84,000
.4	3.1	88	313	3,900	12,000	95,000
.601	3.39	98	430	4,000	12,420	
1.01	4.39	43.6	1,235	4,000	12,500	
1.106	4.5	48.5	1,800	5,231	50,000	
1.21	5.21	84.25	2,200	7,000	55,000	
2.1	12.8	60	2,215	7,800	88,000	

PRECISION RESISTORS—1 WATT—60¢

100,000	145,000	296,000	376,000	580,000	
105,000	150,000	300,000	398,000	600,000	
120,000	166,100	318,000	400,000	650,000	
128,000	220,000	330,000	412,000	645,000	
130,000	250,000	340,000	530,000	650,000	
149,000	280,000	348,000	532,000	666,000	
152,000	270,000	375,000	550,000	676,487	

1 MEGOHM 1 WATT 1%—$1.50—5%—60¢

PRECISION RESISTORS—2 WATT—75¢

4,885	5,000	6,000	10,000	19,917	22,000

UNIVERSAL JOINTS ALUMINUM
3/16" hole x ⅜ O.D.
1-½" long— 50¢
¼" hole x ½ O.D.
1-½" long— 75¢

OIL FILLED

MFD	V.D.C.	Price	MFD	V.D.C.	Price
.1	25,000	28.95	1	1,500	1.49
.25	20,000	19.95	1	1,000	1.39
.15-.15	5,000	2.75	1	1,000	1.59
.2	7,500	1.49	1	1,000	1.49
.25	7,500	1.49	1.02	1,000	.98
.1-.1	7,000	1.98	1	1,000	1.98
.1	7,000	1.98	1	800	1.49
.5	7,000	1.49	1	800	2.98
.75-.05	7,000	1.49	1	800	2.98
.1	6,000	2.75	10	600	2.98
.03-.03	6,000	1.35	8-8	600	2.98
.01-.05	6,000	1.35	6	600	2.98
.3	4,000	4.95	7	600	1.75
.2 x .2	4,000	2.59	4	600	1.49
.1	4,000	2.25	4	600	1.98
.06	4,000	1.49	4 x 3	600	1.98
.1	3,400	1.98	2	600	.99
.25	3,000	2.98	2 x 3	600	.99
.5	3,000	4.95	4	500	.99
8	2,000	4.45			
6	2,000	4.45			
3	2,000	2.75			
.5-.1	2,000	1.98			
.5	2,000	1.98			
.3	2,000	1.75			
.1-.1	2,000	1.49			
.02	2,000	.79			
4	1,500	2.95			
2	1,500	1.79			

2 mfd. 4,000 V.D.C. G.E.
$4.95

OIL FILLED A.C. CONDENSORS

MFD	V.A.C.	Price	MFD	V.A.C.	Price
.2	780	$ .69	30	330	$4.10
4	660	4.95	25	330	3.95
6	660	4.95	20	330	3.89
5	660	4.50	15	330	3.49
4	440	4.25	10	330	2.95
2	660	3.25	8	330	1.95
1	660	2.35	4	330	1.75
15	440	4.95	3	330	2.25
6	440	3.95	2.5	330	1.98
5-5	440	3.95	2	330	.45
4.4	375	2.15	10	220	2.95

1N34 Crystal Diode.....$1.95
300 Twin Lead.....60½ per ft. $18.95 per M
Dynamotor DM 33A.....$5.75 ea.
Chokes: 30 Hy. 8MA @ ...$1.29; 6Hy. 8MA @ ...
Power Tap Switch—OHMITE # 212-5—6 Taps non-shorting 25A 150 V. A.C. .....
Timer—Industrial Timer Corp. 15 min. on, off continuous 115 V. A. C. Fully cased Plugs into panel socket .....
BC-224-D Rec'vr 13 Volts D. C. 1.5 ma to 18 mc. Brand new. Includes tubes, dynamotor, shock mts....$129.00
Mike connector Amphenol 80-61 Interchangeable with Amphenol 80-M cad plated.....25¢
Minimum Orders $3.....All orders f.o.b. PHILA, PA.

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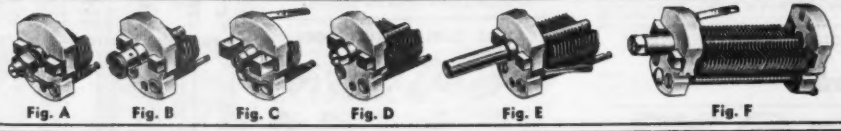

Fig. A Fig. B Fig. C Fig. D Fig. E Fig. F

STOCK NO.	CAPACITY Min.	CAPACITY Max.	MANUFACTURER'S NUMBER	FIGURE	SHAFT LENGTH	POST LENGTH	GROUND LUG	PRICE EACH
2397	2.5	7	Hamm 250034	D	5/16	3/32	Right	18¢
5716*	3	8	ASP 17A234	A	9/16	3/32	Top	25¢
5717	3	10	ASP 22G192	A	9/16	3/32	To Post	18¢
4090	9	15	ASP 481212	E	1"x1/4" D	3/32	Left	25¢
2939	3	15	ASP 217-2	C	5/16	1/4	Top	20¢
5718	3	15	Telrad 682070-30	D	5/16	3/32	Right	20¢
5719	3	15	Hamm 682070-30	D	5/16	3/32	Right	20¢
231	3	25	CAIM 481881	A	9/16	3/32	Left	25¢
5720	3	27	Hamm 11725-1	D	5/16	3/32	Right	25¢
5721	9.5	28	Comar M430864-6	D	5/16	3/32	Top	25¢
5722	3	29	OAK 22G190	A	9/16	3/32	To Post	25¢
5723	3	29	ASP 22G190	A	9/16	3/32	To Post	25¢
2940	9	30	ASP A8H-501	D	5/16	5/16	To Post	30¢
5724	4.5	30	OB7751E-25	D	5/16	5/16	Right	30¢
5086	3	30	Hamm SBL-72265-3	B	1/2	3/32	Bottom	30¢
2941	4.5	35	Hamm ESA682070-37	D	5/16	3/32	Left	30¢
939	5	54	Hamm ESA682070-35	D	5/16	3/32	Left	40¢
5087	5	54	Hamm BL 72265-4	B	1/2	3/32	Right	40¢
5725	4.5	55	Sickles M7466880-2	D	5/16	3/16	Right	40¢
5088	6	100	Hamm SBL72265-6	B	1/2	3/32	Bottom	50¢
5674	5	100	Hamm APCIE100	E	1 1/16"x1/4"D	3/32	Right	75¢
236**	8	140	ASP 19A34504	D	5/16	3/32	To Post	55¢
5675	6	150	Hamm APCIE150	E	1 1/16"x1/4"D	3/32	Right	75¢
5726	9	204	OAK 114M510	F	9/16	3/32	Top	95¢

* Double spaced plates.
** Adjusts both ends, some available w/dust cover.
Fig. A Round Shaft Screwdriver adj. w/locknut.
Fig. B Bakelite Knob ins. Screwdriver adj.
Fig. C Round shaft Screwdriver adj.
Fig. D Hexnut Screwdriver adj.
Fig. E ¼ Round Shaft.
Fig. F Double End Plate.

BUTTERFLY CONDENSERS

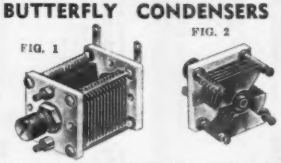

FIG. 1 FIG. 2

9-62 mmfd per section. 6-34 mmfd sections in series. Double ceramic end plates and bearings. ¼" diam. shaft, 6/16" long. 065 Plate spacing end plates 1-⅝" square.

Stock No. 5076-A FIG. 1 Price Each **90¢**

4-22 mmfd per section. 3-12 mmfd sections in series. Single ceramic end plate 1-⅝" square. ¼" diam. x ⅛" long shaft.

Stock No. 5077-A FIG. 2 Price Each **60¢**

TRANSMITTING MICA CAPACITORS

A B C D E F

HEAVY DUTY

Stock No.	Cap.	Test Volts	Fig.	Type No.	Price Each
5493A*	.01	1000	B	1445	$1.35
5494A	.02	1000	B	1445	2.48
5495A	.006	1200	A	A 2	1.40
5496A	.0001	1500	C	BE 15	4.20
5497A	.0005	1500	C	BE 15	4.20
5498A	.004	2500	B	4	6.30
5499A	.001	5000	A	F	7.08
5698A	.0035	5000	A	A2	1.80

* Supplied with Meter Bracket

Stock No.	Cap.	Test Volts	Fig.	Type No.	Price Each
5681A	.15	1000V	E	XS	$1.98
5682A	.00007	2500V	E	3	99¢
5683A	.00005	3000V	E	15L	1.80
5684A	.0001	5000V	E	F2L	1.80
5685A	.0008	5000V	E	F2L	1.80
5686A	.000025	10,000	D	PL-341	1.95
5687A**	.00015	10,000	F	PL-315	7.95

** D.C. Working Voltage

STANDARD BRAND. MFR. NAME ON REQUEST. OTHER TYPES AND SIZES AVAILABLE

TOGGLE SWITCHES

STOCK NO.	MFG.	ACTION	RATING	PRICE
5443A	H & H	S.P.D.T.	6A-125V	35¢
5281A	Carling	S.P.S.T.	10A-125V	39¢
5444A	C-H (B6ft)	S.P.S.T.	5A-125V	25¢

OTHER TYPES AVAILABLE

OIL FILLED CONDENSERS

.045 MFD—16,000 Volt Vitamin "Q". One Ceramic Insulated Screw Terminal 1⅝" x 2⅛" x 4⅝" High Can.

Stock No. 5399A. **$4.95**

Standard Brand. MFR. Name on Request

6.3 VOLT FILAMENT TRANSFORMERS

Primary 115 Volt 60 Cycle 1600 Insulation Three 6.3 Volt Secondaries

6.3 Volts @ 4.9 Amps.
6.3 Volts @ 4.5 Amps.
6.3 Volts @ 1.1 Amps.

Horizontal Half Shell Mounting. 2¼" x 2 13/16" Mounting Centers. 2 13/16" x 2⅝" Core Size. 2⅝" above Chassis. Solder Lug Terminals—All Terminals Marked.

Stock No. 5254 A

Price Each **$2.65**

Terms: Open Account to rated or acceptable reference accounts. Others Pre-payment or 25% deposit with order, balance C.O.D. Price F.O.B. Chicago and subject to change without notice. Merchandise subject prior sale.

Radio Surplus Corp.

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1N48	$ .75	1N65	.72
1N48	2.49	1N72	4.20
1N51	.48	1N73	19.05
1N52	1.53	1N74	14.25
1N52	4.05	1N69	1.23
1N63	3.30	1N70	3.15
1N63	7.65	G5A or G6	2.25
1N75	2.85	**TRANSISTORS**	
1N75	6.66	SX-4A	
1N64	.66	Z-2	17.40

We carry all Nationally Advertised Brands of Radio and Electronic Parts.

Tubes and Equipment.

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½—1—2w 5—10% Tol.

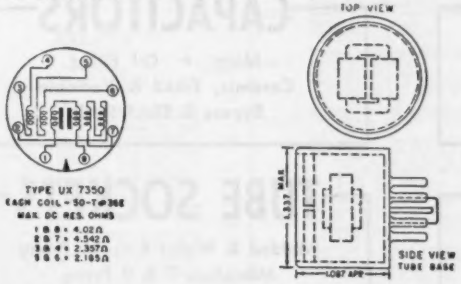
All standard brands
Immediate Delivery

Complete stock of
J and JLU pots
for immediate delivery.

PULSE TRANSFORMERS

Tube base plug in type

Here are precision made, high quality compact pulse transformers wound on hypersil cores. They are built in octal bakelite tube bases and can be adapted to many uses. Kindly distribute this data to key personnel in your Electrical Engineering Department, to your Technical Library, to your Electronic Equipment Buyers and to any person who should have knowledge of this item.



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★—Completely impregnated and sealed.
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★—Convenient to use—merely plug into an octal socket—simplifies production.
★—Schematic of winding sequence and connection pressed into disc covering top of tube base. Schematic designates socket connections.
★—The coils are wound on high-grade tested hypersil cores.
★—Used in some of the Navy's modern and highly accurate Radar and Direction Finding Equipment.
★—Standard types—Manufactured by Raytheon Manufacturing Company.
★—Quantities available—immediate delivery.

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★—Blocking Oscillator, Multivibrator and Scope Circuits.
★—Wherever Accurate Timing and Triggering are necessary.
★—Unexcelled in circuit applications for generating low power and low voltage pulses.
★—Can be used in circuits utilizing repetition rates from 0 to well over 1 MC and pulse widths ranging from .05 Microsecond up.

PRICE $4.50 EACH—Immediate Delivery

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6.3—1A
@ 1.95
3 3/" high
3 1/4" deep

Amphenol 80 C connectors.....$.12 ea.

MICA CONDENSORS

MMF	TOL.	CASE	PRICE
68	5%	CM19	$13 a 100
150	5%	CM19	$13 a 100
390	10%	CM19	$6 a 100
470	10%	CM19	$6 a 100
220	10%	CM20	$6 a 100

GR 371A Pot 2000 ohms 15W..... $1.25
GR 214 Pot 1000 ohms 10W.....$1.25

Westinghouse NA-35 3" round zero—150 V A.C. $5.95

Hermetically sealed—low power audio transformer
Primary 600 ohms at zero MADC
Secondary 8 ohms at same .95

.01—100V
molded paper waxed
dipped capacitors
$.05

Hi-Q Induct. choke
½ mil. rating
$.99

Jan 832 A
$6.95

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ELECTRONIC, TELEVISION & RADIO COMPONENTS

PRECISION RESISTORS

These are standard manufacture; priced ridiculously low. All are brand new, non-inductive, non-spire wire-wound types, insensitive to wide temperature variations. Sizes not listed below can readily be made up by series, and/or parallel arrangements at a fraction of the cost of precision resistors available elsewhere.

500K 1% WMAL $.95
100K 1% WMAL .35

FOLLOWING SIZES ARE 35¢ each:—$27.00 per 100

800K	1%	WW5	600K	1%	WW4
750K	1%	WW5	125K	1%	WW5
700K	1%	WW5	120K	1%	WW5

FOLLOWING SIZES ARE 25¢ each; $19.50 per 100

230K	2%	WW5	7.5K	1%	WW3
92K	1%	WW1	6250 ohms	1%	WW4
84K	1%	WW4	5K	1%	WW3
80K	1%	WW4	4.5K	1%	WW4
74975 ohms	1%	WW4	4.3K	2%	WW3
80K	1%	WM4L	4K	1%	WW3
46K	1%	WW3	4K	2%	WW3
33K	1%	WW3	2.2K	1%	WW3
33K	2%	WW3	1.5K	1%	WW5
25K	1%	WM4L	1K	1%	WM3L
20K	1%	WW3	750 ohms	1%	WW5
17K	1%	WW3	500 "	1%	WM3L
17K	2%	WW3	165 "	1%	WW3
15K	1%	WW3	120 "	1%	WW3
14975 ohms	1%	WW3	110 "	1%	WW3
12.5K	1%	WW3	90 "	1%	WW3
10K	1%	WW3	22 "	1/10%	WW4
10K	2%	WW3	22 "	1%	WW4
10K	2%	WW4	14 "	1%	WW4
10K	2%	WW4	12 "	1/10%	WW4
8K	1%	WW1	10 "	1%	WW4

FOLLOWING SIZES ARE 15¢ each; $12.50 per 100

150K	5%	WW1	250 "	1/10%	WW3
54.5K	1%	WW3	272 "	1%	WW3
26.5K	1%	WW3	235 ohms	2%	WW3
17.5K	1/10%	WW5	70 "	5%	WW3
15K	1%	WM13	60 "	5%	WW3
2.5K	5%	WW3	40 "	5%	WW2
2230 ohms	1%	WW3	30 "	5%	WW3
475 "	1%	WW3	6 "	3%	WW4

FOLLOWING SIZES ARE 10¢ each; $8.50 per 100

53.96 ohms	½%	WW4	4.3 ohms	1%	WW4
23.29 "	½%	WW4	3.94 "	3%	WW4
13.52 "	½%	WW3	3.5 "	5%	WW4
13.333 "	1%	WW4	2.56 "	½%	WW4
5.1 "	1%	WW4	.29 "	3%	WW4
4.4 "	1%	WW2	.25 "	5%	WW4
4.35 "	1%	WW3			

RELAYS

Part No.	Description	Unit Price
1002	Struthers Dunn #61BXX104 D.P.S.T. relay, contacts 25 amp., Coil 12 V.D.C. 17 ohms	.65
1003	GE type K27J851 Antenna switch over relay. Coil 30 ohms 10V.D.C. Contacts D.P.D.T., with double-break for high voltage use. All isolantite insulation.	.85
1004	Western Electric #D-166878. Telephone type relay. D.P.D.T. plus D.P. S.T. normally open. Plus D.P.S.T. normally closed. Heavy duty contacts. Coil 180 ohms. Operates from 6–12 V.D.C.	.85
1005	Telephone Type Relay. S.P.D.T. plus S.P.S.T. normally open. Coil 100 ohms 10–12 volts D.C.	.35
1006	Sensitive subminiature Relay, S.P.D.T. measures ¾"x1"x1¼". Coil 110 ohms. Easily by means of two threaded holes. Operates with less than 1¼ V.D.C., can be used as plate relay. Operates with less than 15 milliamperes.	.75
1007	GE #J106F3. Antenna switchover relay. D.P.D.T. Coil 28V.D.C. 1000 ohms. Isolantite insulation	.35
1019	Allen-Bradley type B8 Starter relay. Coil 24V.D.C. 100 ohms. 50 amperes contacts. S.P.S.T. normally open	.65
1021	Square D type B8 Starter Relay Coil 24VDC. 50 ohms. Contacts S.P.S.T. normally open. 50 amperes	.65
1022	GE #B100F3—D.P.D.T. relay coil 10 V.D.C. 105 ohms	.65
1031	6V.D.C. coil 30 ohms, fully adjustable contacts S.P.S.T. normally open, plus S.P.S.T. normally closed, adjustable spring contact pressure. Solid copper blading posts, includes a 500 ohm 20 Watt resistor for operation on 110 Volts. D.C. coil consists of 1000 ft. of #24 solid enamel wire. Mounted on ¼" bakelite base 6¼"x2⅜x¾".	1.25
1032	RCA Vacuum relay. Relay contacts will break 3000 volts and carry 10 amperes. Solenoid resistance. 200 ohms. 24 volts D.C. excellent R.F. antenna relay	.95
1033	Clare #S18063. D.P.S.T. Miniature type. Coil 140 ohms. Will operate from 10 V.D.C. or 20 V.A.C.	.25
1034	Miniature relay RBM #65526. SPDT plus S.P.S.T. Normally open coil 350 ohms 12–24 V.D.C.	.85
1037	Thermal Vacuum type. Time delay relay. S.P.S.T. Coil 100 ohms 24 V.D.C./A.C. 90 second delay.	.95
1042	Allied type BJX. Operates on 12 V.D.C. Contacts S.P.S.T. Small size	.85
1053	Guardian #34420 type B2. Coil 24 VDC. 180 ohms. Heavy duty double break contacts	.85
1054	Leach type 5053. Starting relay. Coil 24 V.D.C. coil resistance 10 ohms in series with 50 ohm, 15 Watt holding resistance. Very heavy contacts, 1-A and 1-C plus holding contact.	.95
1058	Guardian time delay relay, 24 volts D.C. 266 ohms coil. Contacts make 1, break 1. Delayed starting effected by four 1" diameter, ½" wide, copper slugs under armature end of coil	.95
1060	GE #B105C36. Coil 9000 ohms will operate on 8MA. Contacts double break, double throw	.95
1063	Leach type 12277 relay. Single pole, double break. Coil 24 V.D.C. 180 ohms	.85
1064	Telephone type relay #452—1041. D.P.D.T. Contacts doubled for positive action. Operates on 7 MA. Contacts pressure and armature throw fully adjustable. Laminated core.	.95
1088	Allied control #BOY-X5 coil 6V.D.C. contacts D.P.D.T. plus S.P.S.T. N.C. heavy contacts	.85

TRANSFORMERS

We present a variety of Transformers, chokes, etc., some surplus, some suitable for small production runs, or laboratory, experimental, or replacement purposes.

POWER TRANSFORMERS

Part No.	Description	Unit Price
L730	Pri. 115V 60 cycles Sec. 700 V.C.T. 150 MA., 5. OV. @ 3A., 6.3V. @ 4.8A.—half shell type	3.45
E1108	Pri. 115V. 60 cycles K632132 Sec: 600 V.C.T. 200 MA. 6.3V. @ 3A., 6.3V. @ 4A 5.0V. @ 2A. Standard Shell Construction	4.95
L2913	Multiple section Power transformer Pri: 117V. 60 cycles Sec: 1000V. C.T. @ 100 MA. 500V. C.T. @ 100 MA. 5.0V. @ 3A., 5.0V. @ 2A 6.3V. @ 8A., 12V. @ 1A Full shell construction with leads	4.95
L4582	Oscilloscope or T.V. transformer Pri: 115V. 60 cycles Sec: 4500V. @ 2MA 2.5V. @ 5 Amperes Housed in hermetically sealed case	3.45
L3112	Heavy duty—Power Transformer Pri: 115V. 60 cycles Sec: 800V. C.T. 900 Ma. 2.5V. C.T. 10A.	3.95
6072J	Housed in shielded metal container Power Transformer Pri. 115V. 60 cycles Sec. 750V. C.T. @ 180 MA. 2.5V. @ 3A., 2.5V. @ 6A., 5V. @ 3A.,	2.45
L3335	Shielded in metal upright case Oscilloscope or T.B. Power Transformer Pri. 115V. 60 cycles, 825V. Sec: 2000V. @ 10 MA. C.T. 110 MA. 6.3V & 3A., 6.3V. @ 6A. 6V. @ 3A., 2.5V. @ 1.75 A., 2.5V. @ 1.75 A., 6.3V. @ 3.5 A.,	4.95
L2133	Hermetically sealed with porcelain insulated stud terminals Heavy duty multiple tapped plate transformer Pri: 117V. 60 cycles Sec: The following tapped windings can feed three rectifiers simultaneously at the indicated load currents: 1460V.C.T. 200 MA. 940V.C.T. 110 MA. 650V.C.T. 130 MA. Open mounting with wire leads	6.95
L2134A	Pri: 110V. 60 cycles Sec: 55V. @ .002A 55V. @ .002A 55V.C.T. @ .002A Hermetically sealed in metal case with porcelain insulated stud terminals	
#JX-3301C	Pri: 115V. 400 cycles Sec: 600 V. @ .175 A., 1780 V. Test Hermetically insulated, sealed in metal case with porcelain insulated stud terminals	.75

HEAVY DUTY PLATE TRANSFORMER

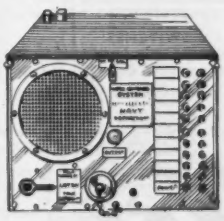
Type CRP 30363
Pri: 220/440V. 60 cycles
Sec: 440V. @ 7.75 AMPS.
440V. @ 7.75 AMPS.
Unshielded with porcelain insulated terminals 12" high, 8¼" wide, 13" length 39.50

1065	Tapped line TRANSFORMER An auto transformer for thousands of uses with the following taps at 60 cycles: Taps wired to male and female octal plugs; 110, 122, 200, 230V. overall dimensions 3x3x3¼". Unshielded type	1.25

FILAMENT TRANSFORMERS

L2132	Pri: 115V. 60 cycles 5V. @ 3A 5V. @ 3A Hermetically sealed in metal case with porcelain insulated stud terminals.	.95
L2133	Pri: 115V. 60 cycles 6.3 @ 3.5A., 15V. @ 4 MA. 15V. @ 4 MA. Hermetically sealed in metal case with porcelain insulated stud terminals.	
L2134	Heavy duty Filament transformer #631 Pri: 117V. 60 cycles Sec: 18V. @ 8A., 1500V. test open 6.3V. @ 8A., 1500V. test mounting 5.0V. @ 3A., 1500V. Test with wire 5.0V. @ 2A., 2000V. Test leads 5.0V. @ 2A., 2500V. Test Unshielded type	2.95
L2122	Filament transformer with high voltage insulation Pri: 115V. 60 cycles Sec. 6.3V. @ 7.5A., 1500V. Test 2.5V. @ 4.75A., 7500V. Test 2.5V. @ 6 @ A., 4000V. Test * 6.3V. @ .72A., * 7.5V. @ .77A., * 8.3V. @ .62A., *10.5V. @ 1.0 A., * Not simultaneous Housed in hermetically sealed case with solderceramic terminals	2.35

10 STATION INTERCOMMUNICATING SYSTEM



An unusual offering in a 10 station intercommunicating system for factory and interoffice communications.

Built for the U. S. Navy Type I-A for 115 volt 60 cycle operations with the following outstanding features:

Operates individually, and separately, by push button control, 10 sub-stations.

Pilot light identification of each substation, on master unit.

Transformer coupled 6V6's in push pull to provide up to 10 watt output.

Amplification provided by 2-6SL's transformer controlled

Rectification by 2-5V3 tubes.

A high voltage test, power transformer providing filament and plate voltage to all six tubes.

Hayden 24 R.P.M. Motor, 10 VAC actuates the switch which blinks pilot light along each substation.

Jansen type NF 101 6½" high fidelity speaker. Weatherproofed.

Tubes and audio transformers mounted, on a shock proof sub-chassis.

Entire unit mounted in a sturdy gray finished steel cabinet 15" x 11" x 10. Weight 48 lbs. net. Each packed in wooden crate.

This unit is priced at a fraction of original government cost.

Price $59.50 each

Substations for above consisting of a 4", 2,702 magnet, Goodman, (British make) high fidelity packed in wooden crate. cabinet.

Price $6.50 each

We have substantially large quantities of desirable electronic materials at bargain prices listed in our catalogue #ED5. To obtain a copy please write to:

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154 GREENWICH ST.
New York, N. Y.
Telephone DI 9-3143

BRAND NEW GUARANTEED
U. S. GOV'T. SURPLUS

POWER RHEOSTATS

Ohms	watt	ea.	Ohms	watt	ea.
.5	25	1.98	250	25	2.23
.5	50	2.81	250	50	2.53
.5	150	5.93	300	50	2.53
1	50	2.81	300	100	4.27
2	50	2.81	350	25	1.98
2	100	4.68	350	100	4.26
2	300	8.42	370	25	1.98
3	100	4.67	375	150	6.59
3	225	6.58	400	25	1.98
3x3	300	29.95	400	75	3.98
4	225	6.68	500	25	1.98
5	25	1.97	500	75	3.95
5	100	4.68	500	50	2.53
6	25	2.23	500	100	4.39
6	75	3.98	500	150	4.68
7	25	1.98	500	300	8.49
8	50	2.53	585	150	6.60
10	25	2.23	750	25	2.23
10	100	4.27	750	150	5.95
12	25	2.23	1000	25	1.98
12	50	2.53	1200	225	7.20
15	25	1.98	1250	50	2.66
15	75	3.98	1250	150	6.59
15	100	4.38	1500	25	2.53
20	50	2.53	1500	50	2.65
25	25	2.23	1800	150	6.24
50	25	1.98	2000	25	2.23
50	50	2.53	2000	50	2.53
60	25	1.98	2250	150	6.24
75	25	1.98	2500	150	5.95
75	75	3.98	2500	50	2.53
75	100	4.39	2500	100	4.68
80	500	12.46	3000	25	2.23
100	25	1.98	3000	100	4.68
100	50	2.53	5000	25	2.53
100	100	4.39	5000	50	2.85
125	25	2.53	5000	75	3.85
150	50	2.53	7500	100	5.31
175	25	2.53	10000	50	3.12
175	25	1.98	10000	100	5.51
200	25	1.98	15000	25	3.29
200	100	4.27	20000	150	8.43
225	50	2.53			

SELECTOR SWITCHES

Pole	Pos.	Deck	Type	Each
1	11	1	Bak-n/shtg	.69
1	21	3	Bak-n/shtg	.89
2	2	1	Cer-shtg	.59
2	6	2	Bak-n/shtg	.69
2	11	2	Cer-shtg	.75
3	4	2	Bak-/shtg	.88
5	3	2	Cer-n/shtg	.98
6	11	6	Bak-n/shtg	1.95
10	5	5	Cer-shtg	2.25
16	2	4	Bak-n/shtg	1.35

Many other types in stock

"AN" CONNECTORS

Large Variety Available
At Great Savings

Send your specs and let us quote

BIRTCHER TUBE CLAMPS

FROM **35c**

#926-A	#926-C5
#926-A1	#926-C10
#926-A14	#926-C24
#926-B	#929-1
#926-B1	#930-12
#926-B7	#930-18
#926-B22	#930-19
#926-C	#930-21

MICROSWITCHES

MISCELLANEOUS

A. MOSSMAN LEVER SWITCHES

B. NOISE FILTERS

C. GLASS FERRULE RESISTORS

D. MALLORY SERIES 2000 PUSH SWITCHES

E. WE-I—PRECISION RESISTORS

See Dec. Issue for Complete Listings of above.

OIL CONDENSERS

Mfd.	Voltages Avail
.1	2-6-20K
.25	2-3-3½-4-5K
.5	600-1½-3K
1	600-1-1½-2-5-6K
2	400-600-1-1½-2-3-4K
4	600-700-1-1½ K
6	400-600-1½-2 K
8	600
10	600-2½ K
15	600-1K
30	90-vac. 2-ph
100	230-vac. 3-ph
3x4	600
3x8	600
4x2	600
4x8	600
2x10	90-vac.

Special Prices on Request

BATHTUBS

Mfd.	Voltages Avail.
.033	400
.1	2-4-600
.1	4-6-1K
.15	600
.25	2-4-600
.25	400
.5	4-6-1K
.75	600
1	1-2-4-6-1K
2	4-600
4	50-100
8	600
25	25-50-75
40	25
50	25
100	15
200	12
300	6
2x.01	2-400
2x.02	6-1500
2x.045	600
.046x.055	600
.2x.05	6-1500
.1x.05	200
.1x.5	400x50
2x.1	4-600
2x.16	600
2x.2	600
2x.25	4-600
.3x.5	500
2x.5	4-600
1.x.05	500
1.x.1	300
1.x5	200
2x1	600
2x10	25
2x200	9
3x.001	600
3x.05	600
3x.1	4-600
3x.25	4-600
3x.5	100-600

.015x.03x.045x.06x.12/.600

Also available CHANNEL Types. Special Price on request.

TERMINAL BOARDS

5 terminal	.88¢
8 terminal	1.67
12 terminal	2.49

SHOCKMOUNTS

100P-1	1 lb.	.15
100P-2	2 lb.	.15
100PR-2	2 lb.	.15
100P-3	3 lb.	.15
100P-6	6 lb.	.20
150P-4	4 lb.	.20
150PH-8	8 lb.	.45
100PL-1	1 lb.	.15
150P-7	7 lb.	.25
156P-6	6 lb.	.35
200PD-15	15 lb.	.59
200PHN-35	35 lb.	.75
204P-112	112 lb.	.95

HIGH POWER TR. MICA

G-1 TYPE

.0001	5KV
.00015	5KV
.0002	6KV
.0003	6KV
.0047	6KV
.005	5KV
.01	4KV
.032	2KV
.04	1KV
.08	1.5KV
.09	1.5KV

G-2 TYPE

.0001	10KV
.00015	10KV
.0002	10KV
.000247	12KV
.0003	10KV
.000375	10KV
.0004	5KV
.0005	10KV
.00065	10KV
.001	6KV
.003	8KV

G-3 TYPE

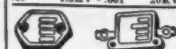
.0001	20KV
.003	20KV
.0034	20KV
.00045	15KV
.0005	20KV
.001	20KV
.0011	20KV
.00124	15KV
.004	12KV
.25	1.6KV
.25	6KV
.001	20KV
.00047	20KV
.015	5KV
.0012	20KV

G-4 TYPE

.0002	30KV
.0025	25KV
.005	6KV
.01	15KV

TYPE 68

.000155	30KV
.000533	30KV
.0004	30KV
.001	30KV



TRANSMITTING MICAS

mfd.	wv	types	ea.
.0001	600	4	.36
.0003	600	4	.36
.00005	600	4	.29
.00005	2500	9	.57
.0001	600	4	.29
.0001	2500	9	.57
.00015	600	4	.36
.0002	600	4	.29
.00025	600	4	.29
.0005	600	4	.29
.0005	2500	4	.75
.0005	2500	9	.77
.0006	2500	9	.85
.0007	600	4	.36
.0075	600	4	.36
.0008	600	4	.36
.0009	600	4	.36
.001	600	4	.36
.001	1200	4	.43
.001	1200	9	.57

mfd.	wv type	ea.
.0015	600 4	.36
.00162	600 4	.42
.002	600 4	.39
.002	1200 4	.72
.0025	600 4	.39
.003	600 4	.43
.004	600 4	.45
.005	1200 9	.99
.006	600 4	.47
.005	2500 9	1.86
.01	600 4	.54
.01	600 4	.65
.01	1200 9	1.41
.02	600 4	.92
.02	1250 9	2.12
.025	600 4	1.08
.03	300 4	.99
.03	600 4	1.34
.043	600 4	1.75
.05	300 4	1.19

(Many other sizes in stock)

"UG" and "UHF" CONNECTORS

UG-9/U	UG-22/U	83-1H
UG/10U	UG-24/U	83-1J
UG-12/U	UG-25/U	83-1AP
UG-14/U	UG-27/U	831RTY
UG-15/U	UG-58/U	83-1SP
UG-16/U	UG-87/U	83-1R
UG-18/U	CW-123/U	83-1D
UG-19/U	UG-206/U	83-1SPN
UG-20/U	82-1AG	82-22R
UG-21/U	83-1F	CN 49151

PRICES ON REQUEST

TYPE "J" POTENTIOMETERS

TYPE "J" $1.50 TYPE "JL" $1.75 TYPE "JJ" $2.95

ohms	ohms	ohms	ohms	ohms
65*†	4000†	75 K†	500-500 *†	130K-130K *
300†	5000†	80 K†	600-600†	150K-150K†
400 *†	6500†	100 K†	1500-1500†	250K-250K†
500†	10 K *†	100 K†	2000-50K *	350K-5K†
600 *†	12K†	125 K *	2200-24K†	350K-25K†
750†	15 K *†	250 K *	5K-45K†	500K-300K†
1000 *†	20 K *†	2meg*	20K-200K†	350K-350K *
1400†	25 K *†	2meg†	25K-10K†	800K-75K*
1500 *†	30 K *†		35K-5000†	2meg-2meg†
2000 *†	50 K *†		50K-25K†	4meg-4meg†

TYPE "JJJ" $4.95

ohms	ohms
20K-200K-20K†	750K-750K-750K†
45K-27K-2500†	800K-800K-800K†
700K-700K-700K†	1meg-1meg-1meg†

* 1/8" screwdriver slotted shaft.
† Knob type shaft.

JONES Connectors — Jones BARRIER STRIPS

P-101-1/4	P-504-DB	S-504-DB
P-101-3/8	P-506-DB	S-504-CE
P-306-AB	P-506-CE	
P-306-CCTL	P-510-CE	2-140-Y
P-308-FHTL	P-512-CE	2-148
P-310-CCT	S-101-D-MOD	18-148-3/4W
P-312-AB	S-302-AB	18-248
P-312-CCTL	S-306-CCT	18-248
P-315-CCT	S-306-CCT	3-141
P-315-CCE	S-306-CCTL	4-141-W
P-315-EB	S-308-AB	4-141-3/4W
P-318-CCE	S-308-CCTL	6-141
P-321-AB	S-315-EB	7-141-Y
P-324-AB	S-315-CCT	10-141-Y MEL
P-324-EB	S-318-AB	12-141-Y
P-324-CCT	S-321-CCE	15-141-Y
P-330-SB	S-330-AB	25-141-3/4W
P-402-SB	S-404-AB	MEL
P-406-AB	S-406-CCT	2-142-Y
P-406-LAB	S-406-CCT	4-142-Y
P-410-CCE	S-408-LAB	3-150
P-2418-SB	S-2408-SB	5-151
P-412-DB	S-410-AB	4-152
P-412-CCE	S-410-CCE	29-168-R
P-2412-SB	S-2412-CCE	29-161-AR
P-502-DF	S-502-DB	

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HARD TO GET ITEMS

- Radio Transmitters Receivers Phone, CW, MCW. Frequency range 1.5 to 12.5 mcs. Model AN/FRC-1. Output approximately 250 watts.
- TDE Navy model radio transmitters with 230 volts, D.C. power supply, complete with tubes, ready for operation. New.
- SF Ships' radar units complete with all components.
- TCS, Collins type Navy and mobile type transmitters-receivers complete with remote control, antenna coil, cables, key, microphone, for 110 volt, A.C. and 12 or 24 volt D.C. Refinished, checked out and guaranteed for operation.
- ET-9023-D1 Radiomarine Corporation telegraph transmitters.
- BC-348 — BC-312 unconverted receivers for 24 and 12 volt operation. Checked out, excellent, guaranteed.
- BC-221 A.K. Frequency meters with modulation.
- BC-221 Frequency meters without modulation.
- TS-174-U Frequency meter with modulation 20-250 mcs.
- LM-15 Frequency meters (Navy version of BC-221 A.K.) with modulation and A.C. power supply.
- I-100A Test sets for SCR-288.
- Telephone or power line insulators, glass Hemingray No. 40, heavy duty.
- W-110 B Army field telephone wire.
- RC-58-B Army Tape Facsimile transmitters-receivers.
- Link radio transmitters-receivers 1498 including remote control and antenna, reconditioned.
- Link-50 UFB transmitters, receivers including remote control and antenna. New.
- BD-72 army field telephone switchboards, twelve lines. Reconditioned, like new.
- BD-71 army field telephone switchboards, six lines. Reconditioned, like new.
- Army Field Telephones, Type EE8. Excellent.

WE HAVE OUR OWN MANUFACTURING AND LABORATORY FACILITIES AND INSPECT AND GUARANTEE ALL ITEMS BEFORE SHIPMENT.

COMPLETE TECHNICAL DETAILS AVAILABLE. QUANTITIES AND PRICES WILL BE SENT UPON REQUEST.

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COLUMBIA ELECTRONICS LTD.

SCR 300

WALKIE-TALKIE normal range 3 miles or more depending on operating conditions. Frequency range: 40.0 to 48.0 mcs. Brand new. Complete.

R-4/ARR-2 RECEIVER

34-58 mcs. Brand new. COMPLETE WITH RACK AND CONTROL BOX.

AN/CRT-3

EMERGENCY RADIO TRANSMITTER. T-74/CRT-3 DUAL FREQUENCY OPERATED TRANSMITTER. Operates on both 8280 kc. and 500 kc. Power output 2½ W. on 500 kc and 2 W. on 8280 Kc. BRAND NEW. COMPLETE WITH PARACHUTE, KITES, LAMP, BALLOON and GENERATOR.

TEST EQUIPMENT
Complete Line!

Signal Generator 804-C
DuMont 224-A Oscilloscope
1-77 Hickok Tube Checker
1-208 FM Signal Generator
RPC Model 644 Multimeter
Ferris Microvolter Mod. 18-C

IE-36 (New)	TS-100/AP
I-122	TS-102A/AP
I-139 METER	TS-111/CP
I-212	TS-126
I-222	TS-127/U
TS-3/AP	TS-170/ARN-5
TS-5/AP	TS-175/UP
TS-108/APN	TS-182/UP
TS-19/APQ-5	TS-184A/AP
TS-24A/APR-2	TS-204/AP
TS-34/AP	TS-250/APN
TS-36/AP	UPM-1
TS-61/AP	(Complete)
TS-62/AP	WE I 193
SL-1 Slotted Line Test Set	Range Calibrator 1-146

MODULATOR UNIT BC-1203-A
With Coupling Heads BC--1201 & BC-1202

RC-184 IFF EQUIPMENT
Complete. Brand new.

APS-4 Complete Radar
Mark 16 Complete Radar
APS-6 Complete

RECEIVERS

APR-4	APR-5
SCR-720 Equipment	MG-19A New

HEADSETS
HS-38 & HS-33 Brand new.

MK-20A/UP
Brand new. Individually boxed.

TELEVISION CAMERA

350 line resolution. Easily converted to present RMA standards. Circuits available with camera. Complete, like new.

SEE COLUMBIA ELECTRONICS AD ON PAGE 364

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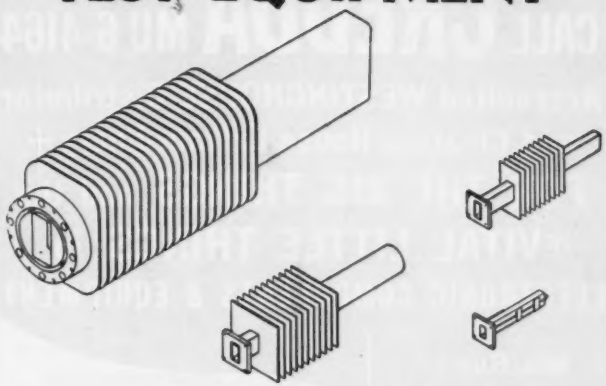
Cable Address COELECT
ALL ITEMS SUBJECT TO PRIOR SALE

TEST EQUIPMENT



HI-POWER DUMMY LOADS

X Band, 1¼" x ½" guide, choke or plain flange, dissipates 350 watts average power continuously in still air, VSWR less than 1.15 between 7 and 10 KMC, weight 5¼ pounds.

X Band, ½" x 1" guide, choke flange, dissipates 250 Watts average power continuously in still air, VSWR less than 1.15 between 8.2 x 12.4 KMC, weight 3¼ pounds.

X Band, 1¼" x ½" guide, plain flange, dissipates 200 watts average power continuously in still air, VSWR less than 1.15 between 7-10 KMC, weight 3¼ pounds.

X Band, 1¼" x ½" guide, plain flange, dissipates 150 watts average power continuously in still air, weight 2 pounds 4 ounces.

S Band, 1½" x 3" guide dissipates 1,200 watts average power in still air, VSWR less than 1.15 between 2.5 to 3.7 KMC, choke flange, weight 13 pounds.

TS-30, X Band Power Meter, measures 1 milliwatt to 1 watt of X Band average power for ½" x 1¼" wave guide,—$200.00.

TS-155 S Band Signal Generator and Power Meter.

X Band Frequency Meter, 8,500 to 9,600 megacycles, direct reading within 25 megacycles; within 4 megacycles with correction chart. Transmission type for ½" x 1¼" wave guide.

X Band Power and Frequency Meter for 8,500 to 9,600 megacycles measures 1 to 1,000 milliwatts average power. The frequency meter is direct reading within 25 megacycles and within 4 megacycles with correction chart; commercial equivalent of TS-230 B/AP.

TS-33/AP X Band Frequency Meter, 8,700 to 9,500 megacycles,—$150.00.

TS-62/AP X Band Echo Box,—$150.00.

TS-110/AP S Band Echo Box,—$150.00.

TS-89 Voltage Divider,—$30.00.

TS-12/AP (Unit 2) X Band slotted line with adapters and probes—$175.00.

TS-100 Synchroscope

T-85/APT-5, 300-1,600 megacycles Noise Modulated Transmitter, 40 watts C. W.

Waveguide Below Cut-Off Attenuator I. 101-A, U. H. F. Connectors at each end, calibration 30-100 db.—$25.00.

Amplifier Strip AM-SSA/SPR-2 contains I. F. amplifier, detector, video amplifier, pulse stretcher and audio amplifier and Rectifier Power Unit PP-155A/SPR-2 bandwidth 10 megacycles, center frequency 30 megacycles, sensitivity 50 microvolts for 10 milliwatts output. Power supply 80/115 V ac, 60-2, 600 cps 1.3 amps. Send for schematic—$85.00 less tubes.

Tuning Units for APR-4 Receiver

TN 16	30- 80 megacycles	TN 18	300-1,000 megacycles
TN 17	80-300 megacycles	TN 19	1,000-2,200 megacycles
		TN 54	2,200-4,000 megacycles

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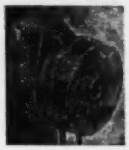

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RHEOSTAT Type K 100 Watt 25 Ohm $3.78

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Relays, mfd. by Sigma 12 volts DC, S.P.D.T. size 2¼" x 1⅛" .....3.77 each

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NEW STANDARD BRAND CHOKES

SWINGING CHOKES

Hy	Mils	Ohms	Price	Volt-age	Case	Wt.
8-40	175	100	$2.75*	5KV	Closed	3.5
8-30	250	80	3.25*	5KV	Closed	4.5
5-25	300	100	3.45*	5KV	Closed	5
5-25	300	90	9.95*	5KV	Closed	18
6-25	300	80	3.45*	5KV	Open	8½
5-25	500	60	12.95*	7KV	Closed	28
9-40	1 amp.	50	39.95*	10KV	Closed	58

SMOOTHING CHOKES

5	500	600	4.95*	2KV	Closed	4
7	150	200	1.25*	2KV	Open	2
10	500	60	12.95*	7KV	Closed	28
12	300	90	3.95*	5KV	Closed	10
12	400	400	4.95*	3KV	Closed	15
15	200	120	2.95*	3KV	Open	4.5
20	300	80	5.95*	4000	Closed	9
20	400	85	4.95*	5KV	Closed	14
20	300	125	12.95*	15KV	Closed	40
16	Ser. 175	96	5.95*	2.5KV	Closed	15
4	Par. 350	24				
26	Ser. 200	112	6.95*	3.5KV	Closed	15
6.25	Par. 400	28				

BC442 ANTENNA RELAY. Contains 50 Mmfd, 5000 Volt vacuum condenser and 6 to 10 amp RF motor. With Antenna transfer switch, transmitt to receive. Brand new..... $3.95*
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WARNING BELL. 24-volt, 3" diameter. Shipping weight, 3-lbs. Brand new..... $2.95*

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AS-65 ANTENNA. APQ-2A. Complete with 7 sections. New..... $14.00*

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CD318A CORD for connecting Throat Mike. Has JK48, PL68 Plugs and SW141 V Switch.. $1.95*

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TBY, MAB (Walkie-Talkies), SCR-500 & 510, SCR-511, SCR 609 & 610, SCR-522, LINK Model 1198, TCS with 12/24/230 DC and 110V, AC Power Supplies, SCR-508/528/608/628.
Jefferson Travis, Model 250-A. Transmitter-Receiver. 50 W. output, 1.5 to 12.0 mc, 8 channels operation—1 VFO and 4 X'tal—both transmitter and receiver. Power Supply operates from either 12/24/32/115 V.D.C., or 115 V. AC, 60 cycles. With Ant. Loading Coil unit, handset, key, & instruction book. Complete.

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Beachmaster 250 W.; Western Elec. Model HLAS—500W.; RCA 25W. (19V); Mobile; RCA MI-2817-F Amplifier, 1,000 Watts (2—500 watt Channels); W.E. Speaker Units D-173246 (25-30 Watts) and D-173232A (50-60 Watts), considerable quantity available, see illus. below.

TEST EQPT.

BC-221, I-222-A Signal Generator, 100-156 MC, with crystal calibrator, for 115 V, 60 cycles AC. **TU-56, TU-57, TS-45, TS-143, I-148, TS-305, TS-143/CPM - 1 Synchroscope. Others.**

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SCR-545-A. Complete in Trailer Trucks, with or without 25 KVA Gas-Engine Generator Unit.
MARK V Training Radar, for schools, training.
Hundreds of radar components, plumbing, magnets, tubes, transformers, etc.

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RBM, RBS, BC-224, DZ-3 Direction-Finders with Loops. **SCR-206** Direction Finders with Loops. **SCR-291 Indicators** and Accessories. **R-2/ARR3.** Others.
CRV-46136, 100 to 1500 KC, part of DP-13 Radio Eqpt.
R-89/ARN-5A Glide-Path Receiver, with crystals. NEW.
RT-3/ARN-1 Radio Receivers, New.
Model ZB-3, Aircraft Homing Adapters, with plugs and accessories. New Eqpt.

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Wilcox 24A Rectifier-Power Supply, for 3 KW modulated transmitter. Designed for use with 4 or more 94C 3 KW Transmitters and 50A Modulator. New, Unused.
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28V. DC to 110V. AC KATO Converters, NEW, good to 300 watts.
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AT-49/APR-4 Antennas.
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ARC-11029	28	250	60
3412	12	220	100
5055	12/24	225/440	100/200
DM	14	240	80

MOTOR-ALTERNATOR

5AS121LJZ
Input 27 V DC
Output 130 V 800 Cycles 1 Phase

MOTOR GENERATOR

PU-7/AP
Input 28V DC
Output-115V AC 21.6 Amps
400 Cycles 1 Phase

BLOWERS

24V DC 1/100 hp—7000 RPM

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24V DC-6000 RPM-UTAH .003 HP
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2J1G1—Selsyns

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All with Cut Cords
Complete with tubes and vibrators
PE 97A PE 117A PE 120A

400 CYCLE TRANSFORMERS

CAT #68G685X
68G686X
68G667

NOISE SUPPRESSOR CAPACITORS

.1 MFD. 200 Volt

OIL FILLED CAPACITORS

MFD.	VOLTS
.005-.005-.01	10,000
.01-.01	12,000
.08	6,000
.03	7,500
.01	12,000
.1	7,500
.1	4,000
.1-.1	7,000
.2	10,000
.2-.2	7,500
.4	10,000
.6-.6-.6	90V 60 CY
.10-.10-.10	90V 60 CY
.15	12,000
.20-.20-.20	90V 60 CY
.25	3,000
3	330VAC 60 CY
3.5	250V 60 CY
9	90V 400 CY
20	90V 60 CY
1.75	330V 60 CY
1	7500V
5	600V
2x5	1000V

Also many other sizes and all size bathtub condensers.

CIRCUIT BREAKERS

24 Volts DC .220 AMPS
115 Volts AC 15 AMPS
24 Volts DC 150 AMPS

T. V. HIGH VOLTAGE CONDENSER

500 MMF—10,000 Volts

POWDERED IRON TUNING SLUGS.
ALL SIZES.

CONTROL BOXES

CAY-33219
J-17/ARC 5
BC 422
CRV 2356
J-23/ARC 4

FERRULE TYPE RESISTORS

Ohms	Dia.	Length
12,500	3/8	4 1/2
50	1/2	2 1/2
400	1/2	3
2000	1/2	2 3/8
5500	1/2	2 1/4
12,000	1/2	3
315	5/8	3
1500	5/8	3
3500	5/8	5
800	1	10
6300	1	7 1/2
16,000	1	5 1/2

Also many other sizes.

ALTITUDE GAIN CONTROLS #55586

Contains 140K ohm ½ watt. Type J. Pot. Control is coupled to an aneroid chamber, setting automatically varies with altitude.

GYRO CONTROL

Contains a motor driven gyroscope friction plate silverstat and resistors. The gyro motor is a 115 V 240 cycle 3 phase 1400 RPM induction motor.

GYRO MOTOR GENERATOR

Is a 115 Volt 60 cycle 3 phase, 2400 RPM motor driving a DC generator with 2 fields. The output of the generator is from 0 to 35 volts. The polarity of the output voltage depends upon which field receives the greater excitation. The magnitude of the output volt is determined by the net excitation of the field.

SERVO MOTOR—24V DC
SHUNTWOUND

Gear box for above equipment

A-D166173 W.E. Video Transformer Frequency response 10KC to 2MC Impedance ratio 50 to 900 ohms; 7-7/32 high x 5-3/4" dia.

BUD MIDGET CONDENSERS

Cat. No.¶	Cap. Max.	Per	Sect. Min.¶	Air Gap
913	35		5	.060
329	35		9	.095

N. C. 800—NATIONAL NEUTRALIZING CONDENSER

STEP-DOWN LINE CORD

For operation of 110 volt AC-DC radio sets from 220 volts AC-DC. Supplied complete with plug and cord.

CHROMALOX AND VULCAN HEATER ELEMENTS

Watts	Volts	Dia.	Length	Mfg.
450	115	3/4	7 3/4	C
280	115	3/4	7 5/8	
175	115	3/4	7 5/8	V
175	115	3/4	7 5/8	C
350	115	3/4	6	C
315	115	5/4	7 5/8	V
200	115	3/4	7 5/8	
200	115	3/4	7 5/8	V
250	110V	3/4	7 5/8	V

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TERMINALS • TUBING • RIVETS • PINS • BRACKETS • WIRE • CABLE • SW.

Genuine TELECHRON Motors

2 RPM $2.90
3 RPM 3.90
2.6 RPM 3.15
1 RPM 3.95
60 RPM 4.30
One of each $15.00

ZENITH 1951 TV Remote Control Motor Units

Reversing switch on end of 17 foot cable. Powerful 4 RPM clutch motor.

Will drive anything
Can be used for door opener, window raiser, model RR turntable. Complete with transformer, $12.90
6 for $70.00

MARKTIME 5 HOUR SWITCH

A 10 amp. timing device. Pointer moves back to zero after time elapses. Ideal for shutting off radios and TV sets when you go to bed. Limited supply at this special PRICE.... $4.90
Also available in 15 min., 30 min., 1 hr. at $5.90

Single Pole 6v. Very Small Relay	$ .90
Veeder-Root Counter, Rotary	.90
Veeder-Root Counter, Ratchet	2.25
No. 18 Enameled Copper Wire, 1¼ lb. coil	2.00
Solenoid, works on 24v. D.C. and 115 v. A.C.	1.50
½ amp. 6 v. Transformer	1.15
4½ amp. sealed 6 v. Transformer	2.75
MD and ACRO Switches assorted	4 for 1.00
115 v. A.C. Motor, for fan or experiment	1.50
1800 RPM, 115 v. A.C. Motor	4.50
Guardian, No. 4, 115 v. A.C. Solenoid	3.50
Guardian No. 2 6 volt DC Solenoid	1.90
Price Bros. No. 1A, 115 v. A.C. Solenoid	1.50

Eby bakelite Binding Posts	.12
TELETYPE 1/40 H.P. 110 v. D.C. Motor	2.90
W-L, 100 watt fixed, 1000 ohm Resistor	.60
Arrow-H & H, DPDT Toggle Switch	.85
C/H Off center, SPDT Toggle Switch	.55

ANTENNA ROTATOR or DOOR OPENER $7.50
Geared down 24v. universal motor with transformer

3 Wire Rubber Cable for Above	Ft. .05½
GE Argon Glow Lamps	4 for 1.00

100 for $20.00

Westinghouse ELAPSED TIME METERS $15.50

General Electric Round Case Smaller Numerals $11.50

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1—Range 0—1000 C
1—Range 0—1200 C
New in original crates
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TELEPHONE RELAYS

Large Stock of
CLARE, TYPES C, D & E
COOKE, AUTOMATIC—ELECTRIC
ALL TYPES of COILS and PILE-UPS

Send Us Your Specs. for Our Quote

CLARE TYPE C SENSITIVE TELEPHONE RELAYS

Coil	Contacts	Will Close At	Price
1) 6500 ohms	1C	2.8 MA	$2.75 ea
2) 6500 ohms	1A-1C	3.2 MA	2.75 ea.
3) 6500 ohms	1A	4.0 MA	3.00 ea.
4) 6500 ohms	1A-1B	4.0 MA	3.00 ea.

CLARE TYPE G SENSITIVE HALF-TELEPHONE RELAYS

1) 6500 ohms	2A	5 MA	$2.50 ea.
2) 5200 ohms	1A	5 MA	2.50 ea.
3) 5800 ohms	2B-1C	5 MA	2.50 ea.
4) 4800 ohms	1A-2C	6 MA	2.50 ea.
5) 3600 ohms	1C	6 MA	2.00 ea.

All above Relays may be used for continuous duty operation on 110V. D.C.

Legend (A) Normally open set of contacts.
(B) Normally closed set of contacts.
(C) Single pole double throw set of contacts.

Sigma Type 5F Low Voltage Sensitive Relays. Has two coils each coil 70 OHMS one volt DC. Enclosed in Dust Cover. Coils may be connected in series or parallel or independently. Contacts are SPST normally closed, but can easily be changed to S.P.D.T.....$3.75 ea.

Sigma 5F Relays same as above but without Dust Cover. Has S.P.D.T. contacts. Price .....$3.00 ea.

Chase Electronic Supply Co.
222 Fulton St.
New York 7, N. Y.
HOlls 4-5033
Digby 4-3088

SCARCE BUYS!

CRYSTAL OVEN—FT-48, BC-48 with 3808.33 & 3848.33 xtals. STD. & Bliley.....$ 9.95
METER—Freq. 350-450 cy. 90-140V. 1/3 of 1% Acc. For aircraft shop, etc. New... 29.00
T-35/APT-5—complete, new 150.00
SIG. GEN.—I-138A "S" band..... 98.00
SIG. GEN.—S-12S CPS DUMONT 215..... 98.00
SIG. GEN.—BC. 423 200 MC radio Mod..... 19.00
RECEIVER—Arc 5 3-6 MC, no dial & Dr.. 4.50
XMITTER—Arc-5.2 meter. Excl condit..... 29.00
XMITTER—500 watt phone deluxe, ham.... 195.00
XMITTER—BC-375 with tubes, new..... 29.00
XMITTER-REC.—TBX. 3-6 MC..... 19.00
XMITTER-REC.—BC-645A, new 19.00
RADAR—APS-3 airborne radar, complete with spare modulator unit..... $95.00
RACK CABINET — 19x9¾H x13Dp. hinged door on top. Blk. crackle, new 5.95
RELAYS—24V. DC. from equip., clean,
DPDT—10 amps. .25
SPST-D.B.—70 amps. .50
TUBING—Surprenant red plastic 1.00 M/M #20 wire, 1500 ft. spool..... 3.95
TV WIRE—Good quality, 1000 ft. spool..... 25.00
72 OHM—Twin-line 7/21 wire, 1 KW..... .06
95 OHM—2 wire shielded co-ax..... .06
TUBE CARTONS—Miniature, per 100..... 1.50
3 MFD—4000 V.—oil cond. top brand..... 4.95
CF/RU COIL SETS—for Rec. & Xmitter..... .95
DYNAMOTOR—rated at 12V. 680V. 210ma. Can be used on 6 V. New..... 14.95
DYNAMOTOR—P.M. 12/24V. 500V. 50ma. set up to 100 ma. on 6/12 V..... 4.95
RESISTOR—25,000 ohm. 40 watt..... .35
RESIS.—10,000 ohm. 120 watt Ind. boxed.. .50
RESIS.—Tapped 750/23/25/7500/3000. 50 W .35
CABLE—235 Amp. lug each end. 11 ft. Lg.. 3.50
CABLE—7 & 9 cond. 10-20 ft. Lg. Shielded.. .10
TERMINAL BLOCK—6—No. 8/32 studs. Elastic stop-nuts. Moulded bakelite..... .25
INSULATOR—Deck entrance type, 3" Dia.. 2.00
CONNECTOR—Cannon DE-37P-1 NE-4642 8 pin male chassis mounting type.

TRANSFORMERS

1470 V. CT.—1.2 Amp. 115V. Pri. new..... 35.00
5V. 100 Amp.—115 V. Pri..... 30.00
24 V. 4KVA—220/440 Pri. 3 Ph. new..... 40.00
CERAMIC COND.—Dual 7-45 MMF. Ad).... .50
FP. COND.—40 MFD—25 V. 15 for..... 1.00
RK-34 TUBE—50¢ each. 5 for..... 2.00
Selenium rectifiers and power supplies.
Panel meters—many types.

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SURPLUS EQUIPMENT

POWER RHEOSTATS

Standard Brands: 6 Ohms; 100 Watt; 4.48 amps 100 Ohms: 100 Watt; 1.0 amp.

Boxed, Brand New with Knob $2.50 each—or—$25.00 per Doz.

ALNICO FIELD MOTORS

(Approx. size overall . . . 3¾" x 1¼" diameter)
Delco-Type 5069220: 27.5 volts; DC; 145 RPM $19.95 ea.
Delco-Type 5069600: 27.5 Volts; DC; 250 RPM .....$19.95 ea.

G. E. MOTOR AMPLIDYNE

Mod. 5AM45DB15. Input: 115 volts, single phase, 60 cycle, 4.5 amp. Output: 250 volts DC, .6 amps, 3450 RPMS.....$79.00 ea.

SINE-COSINE GENERATORS

(Resolvers)

Diehl Type FJE-42-9 (Single Phase Rotor). Two stator windings 90° apart, provides two outputs equal to the sine and cosine of the angular rotor displacement. Input voltage 115 volts, 400 cycle.....$25.00 ea.

Diehl Type FFE-42-1 same as FJE-42-9 except it supplies maximum stator voltage of 230 volts with 115 volts applied to rotor. $25.00 ea.

PIONEER TORQUE UNITS

TYPE 12604-3-A: Contains CK5 Motor coupled to output shaft through 125:1 gear reduction train. Output shaft coupled to autosyn follow-up (AY43). Ratio of output shaft to follow-up Autosyn is 15:1 $70.00 ea.

TYPE 12606-1-A: Same as 12604-3-A except it has a 30:1 ratio between output shaft and follow-up Autosyn.....$70.00 ea.

TYPE 12602-1-A: Same as 12606-1-A except it has base mounting type cover for motor and gear train.....$70.00 ea.

PIONEER AUTOSYNS

AY-1.....26 Volt—400 Cycle.....$4.95
AY-5.....26 Volt—400 Cycle.....$5.95
AY27D $25.50
AY4—26 Volt—400 cyc.....$4.95 ea.
AY30D—26 Volt—400 cyc.....$25.00 ea.
AY38D—26 volt—400 cyc., shaft extends both ends .....$12.95 ea.
AY20—26 volt—400 cyc.....$12.50 ea.

TACHOMETER INDICATOR

SINGLE

Sensitive Type, Kollsman Mark V; Range 0-3500 RPM in 2¼ revolutions of the indicating pointer. $9.95 ea.

TACHOMETER GENERATOR

Pioneer Instrument, Mark V, screw mount. Used with Kollsman Mark V Indicator .....$25.50 ea.
Tachometer Indicator and Generator (above) .....Both $33.50

SENSITIVE ALTIMETERS

Pioneer Part #1556-2K-A Sensitive altimeters. 0-25,000 ft. range . . . calibrated in 100's of feet. Barometric setting adjustment. No hook-up required. $12.95 ea.

420 CYCLE GENERATOR

General Electric #5AB324A7: 115 Volts, single phase, 7.5 KVA, 3480 rpm, equipped with triple V-belt pulley. Cycle and voltage may be varied by varying speed. Price.....$675.00

SMALL DC MOTORS

(Approx. size . . . 4" long x 1¾" dia.
General Electric-Type 5BA10AJ37: 27 volts, DC; .8 amps, 8 oz. inches torque; 250 RPM; shunt wound; 4 leads; reversible $12.50 ea.
G. E. Type 5BA10FJ215, 24 volts DC, .77 amp, 20 lbs. in. torque, 4 RPM... $15.00 ea.
General Electric-Type 5BA10AJ52C: 27 Volts. DC; .65 amp; 14 oz. inches torque; 145 RPM; shunt wound; 4 leads; reversible $12.50 ea.

MICROPOSITIONER

Barber Colman AYLZ 2133-1 Polarized D.C. Relay: Double Coil Differential sensitive; Alnico P.M. Polarized field. 24 V contacts; .5 amps; 28 V. Used for remote positioning, synchronizing, control, etc. $12.50 ea.

PIONEER GYRO FLUX GATE AMPLIFIER Type 12076-1-A, complete with tubes $27.50 ea.

PIONEER TORQUE UNIT AMPLIFIER Type 12077-1-A. A single tube amplifier designed for autosyn take off signal. Contains magnetic amplifier assembly. With tube .....$34.50 ea.

SERVO MOTOR 10047-2-A: 2 Phase; 400 Cycle; with 40-1 Reduction Gear $10.00 ea.

400 CYCLE MOTORS

AIRESEARCH: 115V; 400 CPS; Single phase; 6500 RPM; 1.4 amp; Torque 4.6 in. oz.; HP .03 .....$10.00 ea.
EASTERN AIR DEVICES TYPE JMGB: 200 VAC; 1 amp; 3 phase; 400 cycles; 8000 RPM .....$12.50 ea.

INVERTERS

PE 218 LELAND ELECTRIC

Output: 115 VAC; Single Phase; PF 90; 380/500 cycle; 1500 VA. INPUT: 25-28 VDC; 92 amps; 8000 RPM; Exc. Volts 27.5 BRAND NEW .....$39.95 ea.

MG 158 HOLTZER-CABOT

Input: 24 V. DC, 52 amps; Output: 115 volts—400 cycles, 3-phase, 750 VA, and 28 Volt—400 cycle, 250 VA. Voltage and frequency regulated .....$95.00 ea.

12116-2-A PIONEER

Output: 115 VAC; 400 cyc; single phase; 45 amp Input: 24 VDC; 5 amp. $50.00 ea.

10363 LELAND ELECTRIC

Output: 115 VAC; 400 cycle; 3-Phase; 115 VA; 75 PF. Input: 28.5 VDC; 12 amp. .....$50.00 ea.

16486 LELAND ELECTRIC

Output: 115 VAC; 400 Cycle; 3-phase; 175 VA; 80 PF. Input: 27.5 DC; 12.5 amp; Cont. duty .....$90.00 ea.

SYNCHROS

1F Special Repeater (115V-400 Cycle $15.00 ea.

2J1F3 Generator (115V-400 cyc)..$7.50 ea.

5CT Control Transformer; 90-50 Volt; 60 Cyc. .....$50.00 ea.

5F Motor (115/90 volt—60 cyc.)..$60.00 ea.

5G Generator (115/90 volt—60 cyc.) $50.00 ea.

5SDG Differential Generator (90/90 volts —400 cyc.) .....$30.00 ea.

5DG Differential Generator 90/90 volts 60 cycle .....$50.00 ea.

METERS

AMMETER: DC; 2" 100-0-100, complete with external shunt.....$5.95 ea.

AC Volt, Westinghouse, Type NA-35—3-inch round. F.S.-10 MA.....$6.95 ea.

FREQUENCY, 57-63 cycles per second, 125 volts, mfg. Aero. mod. 7007. 3-inch round $5.95 ea.

KILOVOLTS, 0-4, mfg. Dejur; 3-inch round; mod. 310, less resistor....$3.95 ea.

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AN/APS-2	SA-2	SF
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APS-4	SN	SL
APS-6	SN	SCR-545
APS-13	SO	SCR-729
APS-15	SO	
	SJ	

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AN/CPN-8- 3 cm.
AN/CPN-8-10 cm.
YJ and YG for shipboard use

• **LORAN**
AN/APN-4 and AN/APN-9

• **TELEPHONE EQUIPMENT**
Portable and Stationary Switchboards and Supplies
BD-71, six-line portable switchboard
BD-72, twelve-line portable switchboard

• **CONVERSION EQUIPMENT**
—MOTOR GENERATORS
—CONVERTORS
—DYNAMOTORS
—INVERTORS
—POWER SUPPLIES
—RECTIFIERS

• **TEST EQUIPMENT**

SELECTED EQUIPMENT

TCS—Collins mfd. Navy radiotelephones for shipboard and mobile use, complete with all accessories for operation from 12, 24, 110, 230 volts d.c. and 110 or 220 volts a.c.
TDE—Navy or commercial marine transmitters, complete, 110 & 220 volts d.c. and a.c.
TBK—Navy high frequency transmitter, 2-20 mcs; 500 watts output. Supplied complete with m/g and starter for d.c. or a.c. operation.
TBL—Navy all-wave transmitter; 350 watts output; CW and phone. Supplied complete with m/g and starter for d.c. or a.c. operation.
TAJ—Navy intermediate freq. transmitter, 175-550 kcs; 500 watts output. Supplied complete with m/g and starter for a.c. or d.c. operation.
SCR-284—the famous mobile and ground station for field use. Large quantity of complete sets available.
MAG—10 cm. portable link radar transmitter receivers. 6-volt operation.

TRANSMITTING STATIONS

1 KW—200-500 kcs. complete with 440 volt, 3 ph. 50-60c. power supply—Price $2,500.
800W—(400 watt phone) Western Electric 10-channel, automatic dial selection, 2.0-200 mcs, with 200 volt, 1 ph, 50-60c, power supply. RAMP TRANSMITTER AS USED ON S.S. "QUEEN MARY" —Brand New. Price $4,000.00.
1 KW—FM Broadcast station, complete with monitor, all tubes, antenna and waveguide, Mfr. G. E. $1,500.00—at location, N. Y. C.

★ *All equipment new or reconditioned, checked in our laboratory and ready for operation.*

• **TUBES**
New, Standard Brands Only
—MAGNETRONS
—KLYSTRONS
—TRANSMITTING
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721A/B	$24.50	2J26	$25.00
2K25	87.50	2J27	25.00
2K28	150.00	2J31	28.00
2K28	35.00	2J32	47.50
2K29	27.50	2J36	100.00
2K41	95.00	2J38	28.00
2K45	150.00	2J39	30.00
2K54	150.00	2J42	135.00
2K55	150.00	2J50	75.00
707B	25.00	2J61	75.00
715C	32.50	2J62	75.00
724B	5.00	2J52	125.00
829B	15.00	5J22	25.00
304TH	13.00	5J26	100.00
304TL	13.00		

Special: 889R.....$195.00
892R..... 195.00

CATHODE-RAY TUBES

5BP1	$6.00
5CP1	6.00
7BP7	6.00
12DP7A	25.00

WE GUARANTEE EVERYTHING WE SELL

BRAND NEW STANDARD BRAND TUBES

OA2	1.45	1J6GT	.69	3B7/1291	.59	12A7	.89	217C	8.75	715B	9.50
OA3/VR75	1.47	1L4GT	.65	3B22	2.69	12F5GT	.69	250R	8.95	715C	24.10
OB2	1.49	1LA4	.89	3B24	5.25	12H6	.79	250TH	20.95	721A	4.95
OB3/VR90	1.19	1P5GA	.69	3B26	3.50	12J7GT	.89	250TL	18.95	723A	2.39
OC3/VR105	1.25	1R4/1294	.89	3C24	1.75	12K8	.89	257B	14.95	723AB	14.25
OD3/VR150	.89	1T4	.69	3C28	4.95	12Z3	.79	285A	10.95	724B	3.25
C1A	9.75	1T5GT	.89	3D6/1299	.59	19	.59	286A	18.95	725A	6.25
1A3	1.10	2A4G	.89	3D23	4.75	20	.89	304TH	10.95	730A	20.95
1A4P	.69	2A6	.59	3E29	13.95	22	.89	304TL	10.95	800	1.95
1A6	1.25	2A7	.59	3Q4	.69	24G	1.75	307A	3.95	801A	.49
1B4P	.79	2C21/1642	.65	4B32	4.45	25AC5	1.19	310A	6.50	803	3.50
1B5/25S	.89	2C22/7193	.30	4E27/2578	14.95	34	.59	316A	1.39	805	3.75
1B7GT	.89	2C26	.19	4J22	139.50	RK34	.59	329A	8.95	807	1.60
1B22	6.95	2C26A	.39	4J26	139.75	35/51	.79	331A	8.95	808	2.95
1B26	2.75	2C34/RK34	.59	4J42/700A	84.95	36	.50	353A	4.95	809	2.39
1B27	4.75	2C40	5.95	5C30/C5B	3.75	38	.49	371B	.80	810	12.75
1B36	14.75	2C44	1.00	C6A	5.75	39/44	.49	388A	1.49	811	3.25
1B56	34.95	2E5	.89	6A3	1.25	45 Spec/VT52	.29	417A	8.49	812	3.25
EL1C	2.69	2E22	2.95	6AC5GT	.89	46	.79	450TH	44.50	813	8.50
1C6	.69	2E24	4.85	6AK5	1.35	49	.69	530	16.95	814	3.75
1C7G	.79	2E26	3.49	6C8G	.79	EF50	.89	531	6.75	815	2.89
1D5GP	.89	2J22	7.50	6D8G	.79	CRP72	1.25	533	75.00	822	11.95
1D7G	.79	2J26	24.50	6K7G	.59	FG17	4.50	559	3.95	829	10.95
1D8GA	.79	2J27	24.50	6L7G	.89	RK72	1.25	HY615	.22	829B	14.95
1E5GP	.79	2J30	69.50	6R7G	.99	CRP73	1.25	700A	24.95	830B	3.25
1E5	.89	2J31	24.50	6S7G	.79	RK73	1.25	701A	4.95	832A	9.50
1E7GT	.89	2J32	37.50	6SA7GT	.89	REL5	75.00	702A	3.19	833A	48.75
1F4	.59	2J33	37.50	6SR7GT	.69	FG81A	3.50	703A	5.75	836	4.75
1F5G	.69	2J36	89.50	6T7G	.79	VT90	.98	704A	.95	837	2.49
1F6	.79	2J40	37.50	6U7G	.59	VT99	75.00	705A	2.75	838	3.95
1G4GT	.79	2J61	39.95	6Z Y5G	.79	100TH	7.95	707A	9.95	843	.25
1G5G	.79	2J62	42.50	7C4	.69	HY114B	.75	707B	17.25	846	49.95
1G6GT	.69	2K25/723AB		7E5	.89	VT127	2.50	710A/8011	.75	851	48.75
1H4G	.79		29.25	7E6	.79	205B	3.95	713A	.98	860	5.50
1H6G	.69	2V3G	.98	10Y	.75	211	1.75	714AY	5.75	861	22.25
1J6G	.69	2X2	.59	12A6	.79	715A	5.95	864	.75	865	1.25
										866A	1.35
										869B	39.50
										872A	2.35
										GE872A	3.95
										874	1.25
										876	.59
										879	1.43
										931A	5.95
										954	.35
										955	.45
										956	.69
										957	.45
										958A	.59
										CK1005	.75
										CK1006	3.49
										E1148	.33
										1608	4.95
										1613	.89
										1616	.89
										1619	.45
										1624	1.40
										1625	.40
										1626	.40
										1629	.35
										1636	2.95
										1642	.98
										2051	1.09
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										8001	14.95
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										8012	2.75
										8013A	4.75
										8020	1.25

8025A	7.95
9001	1.50
9002	1.25
9003	1.75
9004	.55
9005	1.75
9006	.89
C5B	3.75
C6A	5.75

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3CP1/S1	1.95
3DP1	4.75
3FP7	1.85
4AP10	4.50
5AP1	3.49
5FP7	3.95
7BP5	18.95
10BP4	17.95
12LP4	20.95
12LP4A	22.25
14BP4	26.50
16DP4A	34.00
16RP4	35.00
17BP4A	35.00
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19AP4B	61.25
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6 Amp. Rectigon Westinghouse 4.75

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1—Friez Recording Microbarograph Cat. # 792, serial # 247-40, Signal Corps type ML-3-A, 4 day clock chart is 6¾ inches high.

1—Friez Psychrometer, (Humidity) Cat. # 873, complete with 110 volt 60 cycle motor and tables.

1—Friez Thermograph, —30 deg to plus 130 deg Fahrenheit, complete with set of gears for different chart speeds. Chart 4½ High.

1—Taylor Anemometer, Velocity in feet, 4" diameter, large sweep dial 0-100 feet, and a 3 dial register, 0-10 in hundreds, 0-10 in thousands, and 0-10 in ten thousands, with carrying case, and correction charts.

1—Alnor velometer, 0-300 and 0-3000 feet, also 0-2 inches of water. Type 3003 complete with 3 jets for above ranges in a carrying case.

These instruments have been used but are in good condition. Subject to your inspection and acceptance. All five instruments, as a lot only. List price over $1,400. Your net cost $600.00.

SPECIAL METERS

Decibel, —10 to 6, Weston 201-61 3½" rd. . @ $11.50
Rect. Milliammeter, 1.1 MAAC Weston 543-51, no scale ..... @ $6.50
Meremhes meter, 1.4 MADC Simpson 3½" rd @ $6.50

TEST INSTRUMENTS

Simpson 200 Set Tester..... @ ** $38.95
Simpson 240 Hammeter..... @ ** 26.95
Simpson 330 V.O.M.A..... @ ** 24.95

RECORDING INSTRUMENTS

Send for complete details

A.C. Voltmeter, 230 volt, Westinghouse type U @ $65.00
A.C. Voltmeter, 220 & 440 volt, Westinghouse type U ..... @ $75.00
A.C. Ammeter, 5 Amp. Westinghouse type U @ $60.00
A.C. Voltmeter, 500 volt, Westinghouse type GY-40 @ $125.00
Polyphase wattmeter, 230/460 volts, 5 amps, Westinghouse GY-40 ..... @ $150.00

MISCELLANEOUS

Frequency meters, 58-62 cycles, 115 volt, switchboard type, Westinghouse RT..... @ $60.00
Port. Tachometer, Jones Metorola, 3 ranges from 300 to 12,000 RPM..... @ $37.50
Gasoline Heater, GN-3-34..... @ $22.50
Radio Receiver BC-1161-A..... @ $34.50
Radio Transmitter BC-1160-A..... @ $29.50

A.C. VOLTMETERS

15 Westinghouse 3½" rd..... @ $5.50
15 General Electric 3½" rd. 800 cycles..... @ $5.95
40 Westinghouse 2½" rd metal, bl. scale, 60 cycles @ $4.50
40 Westinghouse 2½" rd metal, bl. scale, 400 cycles @ $4.50
40 Weston 3½" rd metal bl. scale, 400 cycles @ $4.50
75 Weston 2" rd metal non-flanged, ring mtd @ $6.00
150 Simpson 3½" rd..... @ ** $8.50
300 Simpson 3½" rd..... @ ** 10.80
300 Triplett 3½" rd metal..... @ $6.00

A.C. AMMETERS

100 milliamp Weston 3½" rd 400 cycles..... @ $7.50
250 milliamp General Electric 3½" rd made for DAGO @ $8.50
1 Amp Simpson 3½" rd..... @ ** $5.10
3 Simpson 3½" rd..... @ ** 5.10
5 Simpson 3½" rd..... @ ** 5.10
15 Simpson 3½" rd..... @ ** 5.10
25 Simpson 3½" rd..... @ ** 5.40
50 Simpson 3½" rd..... @ ** 5.10
200 Simpson 3½" rd. 5 Amp less transf..... @ ** 5.10
Current Transformer Weston 200/5..... @ $7.50

D.C. MICROAMMETERS

50 Simpson 3½" rd. 2000 ohms..... @ ** $11.85
100 Weston 643 4½" rd. approx. 1500 ohms.. @ $21.00
200 Simpson 3½" rd. 1000 Ohms..... @ ** $8.00

R. F. AMMETERS

1.5, General Electric, 2½" rd. metal case, bl. scale @ $3.50
1.5 Weston, 2½" rd. metal case, bl. sc..... @ $4.50
2. Weston, 2½" rd..... @ $4.50
2.5, Simpson, 2½" rd..... @ $4.50
2.5, Weston, 3½" rd..... @ $5.50
2.5, McClintock, 3½" rd..... @ $5.50
2.5, Westinghouse, 3½" rd..... @ $6.00
3, Westinghouse, 3½" rd..... @ $6.50
3, Weston, 3½" rd. with ext. couple..... @ $6.50
5, General Electric, 3½" rd. with ext. couple @ $3.50
5, General Electric, 3½" rd..... @ $3.50
6, General Electric, 2½" rd. bl. sc..... @ $4.50
9, General Electric, 2½" rd..... @ $3.50
8, Simpson, 2½" rd..... @ $4.50
8, Westinghouse, 3½" rd..... @ $7.50
10, Weston, 3½" rd. JAN..... @ $8.50
10, Weston, 3" square..... @ $8.50

D. C. MILLIAMMETERS

1, McClintock, 3" square..... @ $6.00
1, Simpson, 3½" rd..... @ ** $8.70
2, Westinghouse, 2½" rd..... @ $3.50
3, Gruen, 3½" rd. spec. sc. @ $3.50
5-0-5, Western Electric, 3½" rd. spec. sc., concentric mvt. ..... @ $4.00
15, General Electric, 4" x 4½" case..... @ $4.95
15, Simpson, 3½" rd..... @ $4.00
25, General Electric, 3½" rd..... @ $3.50
100, Simpson, 3½" rd..... @ ** $8.70
150, General Electric, 3½" rd..... @ $3.50
150, General Electric, 3" square..... @ $3.50
150, Gruen, 3½" rd..... @ $3.95
150, Triplett, 3" square, bl. scale..... @ $3.95
150, Electel, 3½" rd..... @ $4.00
150, Roeda, 3½" rd..... @ $4.00
200, Simpson, 3½" rd..... @ $5.95
200, Marion, 3½" rd..... @ $4.00
300, Gruen, 3½" rd..... @ $4.00
300, Simpson, 3½" rd..... @ ** $8.70
300, Simpson, 3" square..... @ ** $8.70
400, Triplett, 3½" rd. made for Garfield Mod. App. Co. ..... @ $4.50
500, Simpson, 3½" rd..... @ ** $8.70
500, Simpson, 3" square..... @ ** $8.70
500, General Electric, 3½" rd. metal case... @ $3.95
500, General Electric, 2½" rd. bl. scale..... @ $3.95
600, Dejur, 3" square..... @ $4.00
600, General Electric, 3½" rd..... @ $5.50
800, Dejur, 3½" rd..... @ $4.50
1000, Western Electric, 3½" rd. concentric style @ $4.50
1000, Electel, 3½" rd. scale "100 X 10"..... @ $3.50

D. C. AMMETERS

1, General Electric, 3½" rd..... @ $5.50
1, Westinghouse, 3½" rd..... @ $5.00
30-0-30, Triplett, 3½" rd. metal..... @ $4.50
30-0-30, Roeda, 3½" rd. metal..... @ $3.00
30-0-30, General Electric, 3" rd. metal..... @ $4.50
200, Weston, 3½" rd. with shunt..... @ $7.50
200-0-200, Weston, 3½" rd. with shunt..... @ $7.50

D. C. VOLTMETERS

5/125, DUAL RANGE, Weston, 2" rd. metal non-flanged case ..... @ $4.00
15, Simpson, 3½" rd..... @ $3.85
30, Gruen, 2½" rd. metal case..... @ $3.50
150, Hoyt, 3½" rd. metal case..... @ $6.00
150, General Electric, 3½" rd. 1000r/v..... @ $7.50
300, Simpson, 3½" rd..... @ ** $3.85
300, Sun, 2½" rd 1000 r/v, JAN..... @ $7.00
500, Weston, 2½" rd. 1 MA, with resistor... @ $9.50
2 KILOVOLTS, General Electric, 3" square, 1 MA, with precision multiplier..... @ $10.50
4 KILOVOLTS, Dejor Ansco, 3½" rd. 1 MA, less multiplier ..... @ $4.50

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6B8	.60	12F5GT	.48
6B8G	.55	12K8GT	.50
6J8G	.65	50	.65
6L7G	.65	70L7GT	.85
6S7G	.60	85	.57
6U7G	.50	807	1.40
12A6	.50	1619	.40

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TELEPHONE PLUG, Equivalent to PL-55, with Screw Terminals Inserted. Samples furnished to quantity users....New. $.30

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Type	Capacity	
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354	.85	864	3.95
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5BP1	4.95	955	.45
5D21	14.50	1DY	.35
5FP7	1.60	10	.35
5U4G	.60	30/31	.35
5Z3	.60	30/44	.35
6AC7	.85	9T4C	.35
6AQ7	1.85	VT-52	.45
6C8	.60	1616	.75
6C6	.60	1619	.35
6C8G	.95	1642	.40
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6J5	.45	C6J	3.50
6K7	.70	12SLY	.35
6L6	1.60	12A8	.35
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TCS . . Collins 18 Q Transmitter and Receiver

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5 WATT, Model JT-52

by Jefferson-Travis, 2 channel, crystal controlled recvr-transmitter, built-in speaker, hand microphone, 6 Volt DC power supply. Freq: 2000-3000 KCS, in compact steel cabinet, complete less xtals. New in original cartons. In dealer quantities.

BENDIX 70 WATT TRANSMITTER AND RECEIVER

for 24/28 Volt DC operation, complete and NEW with all accessories and spare parts.

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S/N Portable Radar

10 cm. Complete. Brand new. With steel spare parts chest. Input 110v. ac or dc. Mfg. by Gen. Elec. Range 5 to 25 miles.

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TRANSMITTER & RECEIVER & COMBINATIONS

TDE—US Navy, 300-15, 100 Kcs, 125 W on CW, 35 W phone NEW

BC-325—Phone/CW 400 Watts Medium Freq. NEW

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TWT FB-50A—Portable Broadcast Transmitter. NEW

RBZ—Portable Short Wave Receiver. NEW

SCR-500; SCR-800; SCR-510; SCR-511; SCR-528; SCR-608; SCR-609; SCR-610; SCR-628; WALKIE-TALKIES and HANDY TALKIES, Test Sets IE-36 and I-136.

Maintenance spare parts for most of the units on this page.

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Point-to-point communications

Freq. Range: 2000 to 20,000 Kcs.

Output: 350 Watts C.W. 250 Watts Radio telephone

Input: 190 to 250 Volts AC 50/60 cps.

Size: 60" high, 17" wide, 27" deep

Tubes: 827s, 815s, 805s, 866s

Crystal Oscillator unit built-in, fully shielded and stable. All self contained including antenna network. Master Oscillator unit (available) fits in place of Xtal unit. Speech amplifier is only external unit and has 110/220 v. AC input, four stages, high gain. Total net weight, 825 lbs.

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TS-6	TS-62	TS-153	CLQ-60	
TS-10	TS-74	TS-159	D-130637	TRANS.
TS-14	TS-76	TS-203	I-143	APQ-2
TS-15	TS-91	TS-206	I-194	APT-1-2-5-5A
TS-16	TS-92	TS-218	I-203A	ARQ-5
TS-19	TS-98	TS-226	I-208	ART-3-7
TS-24	TS-100	TS-268	I-212	AXT-2
TS-26	TS-102	APA-11	I-223	TPS-2
TS-27	TS-111	BC-221	LM-8	
TS-33	TS-118	BC-376	LM-15	RECVRS:
TS-35	TS-125	BC-638	LS-1	APM-9
TS-36	TS-126	BC-905	LW	APR-5A
TS-45	TS-127	BC-906	OAP-1	ARN-8
TS-47	TS-131	BC-978	OAV-1	ARQ-8
TS-59		BC-1236		

RECEIVERS CPN-3 RA 10 DB TPS-2 RT-48ATPX-1
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Specialists in Test Equipment

This month we feature the 3CM favorites, TS-12 and 13. The TS-12 being a complete SWVR set in two parts including a slotted line detector and amplifier, while the TS-13 as its companion signal generator provides both a sweep meter and power monitor. This device generates either pulsed or CW power over the range of 9305-9445MC/sec. Built in pulsing circuits permit triggered or self synchronous operation while direct reading of power may be had from a temperature compensated thermister bridge. A calibrated attenuator and voltage regulated power source make this an outstanding piece of laboratory equipment.

Other pieces available include:

TS-1ARR
TS-3A/AP
TS-8A/U
TS-10A/APN-1
TS-11/AP
TS-12
TS-13
TS-14
TS-15B/AP
TS-16/APN
TS-19
TS-23/AP
TS-27/TS
TS-32A/TRC-1
TS-33/AP
TS-34/AP
TS-34A/AP
TS-35/AP
TS-36/AP
TS-24/APM-3
TS-46/AP
TS-47/APR
TS-51/APG-4
TS-56/AP
TS-61/AP
TS-62/AP
TS-69/AP
TS-76/APM-3
TS-87/AP
TS-89/AP
TS-96/TPS-1
TS-98/AP
TS-100/AP
TS-101/AP
TS-102/AP
TS-108/AP
TS-110/AP
TS-111/CP
TS-117/GP
TS-118/AP
TS-125/AP

TS-127/U
TS-131/AP
TS-144TRC-6
TS-153
TS-155A/AP
TS-170/ARN-5
TS-173/UR
TS-174/U
TS-175/U
TS-184/AP
TS-197/CPM-4
TS-203/AP
TS-204/AP
TS-220/TSM
TS-226A
TS-233/TPN-2
TS-251
TS-263
TS-268
TS-270A/UP
TS-281/TRC-7
I-95/A
I-106/A
TS-487/U
TS-421/U
TS-314/FSM-1
I-56
TS-389/U
TS-301/U
I-122
TS-323
I-130A
I-145
I-177
I-178
I-208/A
I-212
I-222/A
I-225
I-233
TS-334/U

IE-21/A
IE-36
IF-12/C
IS-185
AN-PNS-1
BC-221(*)
BC-376
BC-638
BC-906/D
BC-949/A
BC-1060/A
BC-1066/A
BC-1201/A
BC-1203
BC-1236/A
BC-1255/A
BC-1287/A

BC-1277
BE-67
LAD
LAF
LAG
LM13
LU2
LU3
OAA-2
P4E
TAA-16EA
TS545E
TS735E
TSX4SE
TT5-4BR
TTX-10RH
TUN-9HU

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Each piece is laboratory tested to assure compliance with the original specifications.

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Last of the HI WATTERS!

RADIO TRANSMITTER

BC-375-E, Complete Equipment, has Dynamotor, Tuning Units, all tubes, etc.

VERY LARGE QUANTITY

150 watts - Made by General Electric Company

Write or telephone for prices.

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ANTENNA KNIFE-SWITCH SW-225. Square D Co. #1513-DAY-44. 3-pole, 2 position, on porcelain posts 2¾" high; bakelite base 7¼" x 5" x ½" thick. Stg. C. Stock #3258225. NEW. Boxed. ea. $1.95

HEADSET ADAPTER MC-385-C. Matches hi to low imp. for HS-33 or HS-38. Has jack for PL-55. Stg. C. #4AK985C. NEW cond., Boxed.....ea. 95¢

CONTROL UNIT RM-23. Permits patching 6 radio receivers to 5 phone channels. P/o BC-16, -188. Stg. C. #2C679-23. NEW cond.....ea. $29.95

CONTROL UNIT RM-28. P/o SCR-581, -572, -642. Stg. C. #2C679-28. NEW cond., ea. $49.95

DYNAMOTOR PE-94. D-C in, 28 V.; D-C out, 14.5 V., 4.0 A., 300 V., 240 ma., and neg. bias 150 V., 10 ma. P/o SCR-522. Stg. C. #3H1894C. Good used cond. F.O.B. Kingman, Ariz. ea. $6.95

WRITING STANDS MC-309-B. Holds tape for writing. P/o Facsimile Equt. BC-58. Stg. C. #6M2200B. NEW cond. Ideal for memos., sheds, etc.....ea. $1.98

CORD CD-685. Two 6½ ft. tinsel conductors, eyelets, spades. Stg. C. #3E1605-6.5. NEW...ea. 19¢

CONNECTORS: 4106-P, w/AN-3054-24. (Bunsen), AN-3108-22-10P Amphenol.....ea. 49¢
RSK-S2-22C-¾" Plug, w/RSK-S2-31SL Socket (Cannon), set $1.49. Many more types, incl. UG.

JACK BOX BC-1368. Packard-Bell #873-DAY-44. Has jacks for PL-55, PL-68 plugs; wafer switch; 2 pointer knobs; 11-pin plug/jack assembly w/silver-plated banana plugs; 200K ohm pot. In metal case. Stg. C. #3C2250. NEW, boxed.....ea. 98¢

11-PIN PLUG/JACK ASSEMBLY. P/o Jack Box BC-1368 (see item, above). NEW.....ea. 49¢

OIL-FILLED DUAL CAPACITOR 305-1614M. #256374. Capacities 0.1- & 0.5-mf./2,000 V. D. C. Can 2" sq. x 3¾" high; has screw terminals on ceramic posts.....ea. $1.19

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809	2.95	1616	.49	1625	.45	5656	1.50	6883	1.50	7588	1.50
810	9.50	5814	.49	1629	.49	5670	4.00	6883A	1.50	7589	1.50
811	2.95	1624	1.50	1630	.49	5671	4.00	7025	1.50	7590	1.50
813	8.50	1625	.45	1632	.49	5672	1.50	7027A	1.50	7591	1.50
829	9.95	1629	.49	2050	1.75	5675	1.50	7034	1.50	7592	1.50
829B	12.50	1630	.49	2051	1.75	5676	1.35	7035	1.50	7593	1.50
830B	1.25	1632	.49	2052	1.75	5677	4.50	7036	1.50	7594	1.50
832	5.50	2050	1.75	2053	1.75	5678	4.00	7037	1.50	7595	1.50
832A	$3.50	5613	—	5647	4.50	5679	1.35	7038	1.50	7596	1.50
836	3.75	5647	4.50	5651	3.50	5686	1.50	7039	1.50	7597	1.50
837	1.49	5651	3.50	5670	4.00	5687	1.50	7040	1.50	7598	1.50
838	2.95	5654	1.50	5671	4.00	5688	1.50	7041	1.50	7599	1.50
845	3.95	5670	4.00	5676	1.35	5689	1.50	7042	1.50	7600	1.50
851	39.50	5676	1.35	5678	1.50	5690	1.50	7043	1.50	7601	1.50
852	22.50	5678	1.50	5762	4.50	5691	1.50	7044	1.50	7602	1.50
860	11.80	5744	6.80	5814	.49	5692	1.50	7045	1.50	7603	1.50
872A	2.75	5751	5.80	5840	4.95	5693	1.50	7046	1.50	7604	1.50
874	1.95	5762	4.50	5842	4.95	5694	1.50	7047	1.50	7605	1.50
884	1.75	5814	4.95	5844	4.95	5695	1.50	7048	1.50	7606	1.50
921	1.75	5840	4.95	5845	4.95	5696	1.50	7049	1.50	7607	1.50
923	1.50	5842	4.95	5847	4.95	5697	1.50	7050	1.50	7608	1.50
927	1.50	5844	4.95	5848	4.95	5698	1.50	7051	1.50	7609	1.50
931A	5.95	5845	4.95	5849	4.95	5699	1.50	7052	1.50	7610	1.50
955	.49	5847	4.50	5850	4.95	5700	1.50	7053	1.50	7611	1.50
956	.49	5848	4.95	5851	4.95	5701	1.50	7054	1.50	7612	1.50
1000	.49	5849	4.95	5852	4.95	5702	1.50	7055	1.50	7613	1.50
1613	.49	5850	4.95	5853	4.95	5703	1.50	7056	1.50	7614	1.50
1614	.49	5851	4.95	5854	4.95	5704	1.50	7057	1.50	7615	1.50
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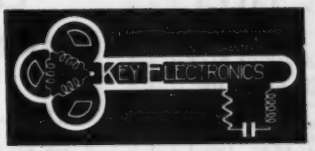

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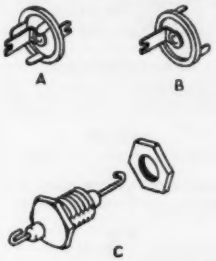

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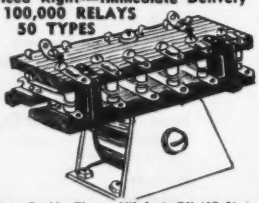

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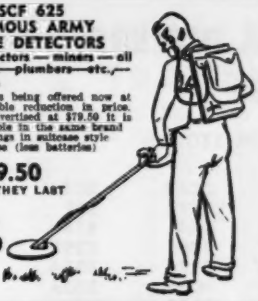

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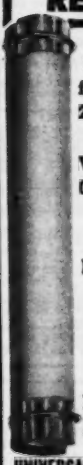

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1B23	8.00	101-D (WE)	1.25	837	1.10
1B26	2.50	101-F (WE)	1.25	866-A	1.25
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6A7	6L7	41	304TL	8012
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5V4	1.20	6BQ6	1.59	12AU7	1.19
5Z4	1.20	6C4	.85	12AX7	.95
5Z3	.85	6CD6	2.25	12AY7	4.50
6AB5/		6H6M	.85	12BA6	.69
6N5	1.25	6J7GT	.80	12BE6	.69
6AC7	1.29	6K6	.75	12H6	.59
6AG5	.90	6N7M	1.20	12JGT	.65
6AG7	1.65	6R6	1.50	125K7GT	.79
6AK5	1.20	6SH7	.95	25W4	.90
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TZ40	3.25	809	2.25	9001	1.75
CK70	4.95	829B	13.95	9002	1.50
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1B5	.79	1642	.99	304C	.39	5UR29/723AB	27.45	617C	14.95	725A	11.95	837	1.79	AB150	2.75	8025	4.99
1BC	.39	2X2	.74	308A	9.95	2V3G	1.69	703A	5.95	807	1.69	864	.36	CE-1	.79	8034	.39
120A	.69	2AP1	4.95	2B22	3.19	3T1B	.39	704A	.99	811	2.89	865	1.15	CEP-120	1.09	8036	.39
1B29	2.75	231D	1.69	2C26	.39	3B27	3.49	705A	1.49	813	8.25	866A	1.39	CEP-220	1.29	8038	1.39
1B32	4.39	2051	1.22	2C32/7193	.39	3C24	1.69	713A	.95	833	3.59	872A	2.79	CJ6	5.95	8052	1.39
1B51	1.69	801A	.59	2C40	4.95	3C25	4.69	714AY	4.99	836	3.49	876	.27	CK1005	.59	304TH	12.95
1613	.99	12AY7	2.49	2C44	1.45	3C34	5.95	715A	6.55	838	4.95	878	1.89	CRP72	1.98	304TL	12.95
1616	.95	5814	3.35	2J61	42.25	3D23	4.69	715B	8.95	844	3.59	924	1.39	F-123A	7.62	383A	5.95
1619	.32	250B	3.89	2J62	42.25	3EP1	5.19	715C	19.95	845	9.25	954	.35	HF 100	6.99	394A	8.50
1624	1.89	217A	7.95	2J72	7.90	4D23	7.95	718AY	39.95	8298	3.69	955	.42	RK 34	.59	3A8	1.89
1625	.38	276A	9.55	2J71	9.49	4A11	.19	718CY	39.95	832	8.95	956	.42	RKR72	1.04	VR-105	1.79
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Ballantine MG set. NEW 1KVA single-phase, 400 cycle alternator. 115V. Separately excited. Belt-driven by 2 HP motor, 220V, 3 ph., 60 cy. With voltage regulator & variable speed sheave. $250.00

Newton MG set. 3½ KVA, single-phase, 400 cycle. Belt-driven by 7½ HP motor, 220V, 3 ph., 60 cy. With voltage regulator & variable speed sheave. $795.00

Pioneer-Gen-E self-excited alternator, 115V, single-phase, 400 cycle, 1.25 amps. Belt-driven by 220V single-ph., 60 cy. synch. motor. With voltage regulator & variable speed sheave. Frequency variation less than 2%..... $145.00

Continental DC to AC 800 cycle MG set. Motor: 230V DC. Generator: 120V AC. .6KW single-phase and 14V DC..... $80.00

Raytheon Voltage Stabilizer, Spec. #W-5790. Input: 225V±10%. 8.7 amps. 60 cy. single ph. Output: 11.0/11.0/220V. 1620 watts. PF: 100 $150.00

American Plate Transformer. Type OISC. 19.4 KVA cont. 60 cy., single ph. Add. polarity. %IZ-75°C-4.0. Indoor service. Primary volts 115. Secondary volts 17,600. With retard coil.... $150.00

10 ASSORTED CIRCUIT BREAKERS—G.E., I.T.E., and De-Ion.

1 unit —15 amp. 1 unit — 50 amp.
2 units—25 amp. 3 units—100 amp.
2 units—35 amp. 1 unit —200 amp.

Price for lot $100.00

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GEneva 6-6278

WE HAVE LARGE QUANTITIES OF **RADIO TUBES**

TYPE	PRICE	TYPE	PRICE	TYPE	PRICE
OZ4A	$0.70	6BQG	$0.93	6SK7GT	$0.96
1C6GT	0.78	6BE6	1.10	6SN7GT	1.20
1LN5	0.80	6C4	0.86	6SS7	0.95
1R5	0.90	6C5GT	0.51	12A6	0.48
1S4	0.86	6C6	0.75	12SH7	0.96
1T4	0.86	6H6	0.94	12SK7	0.98
5U4G	0.80	6J5	0.60	12SQ7GT	0.90
6AB7	0.90	6J5GT	0.51	12SR7	0.90
6AC7	1.20	6K6GT	0.91	35Z4GT	0.85
6AL5	1.00	6K7GT	0.70	35Z5GT	0.75
6AQ5	1.40	6SG7	0.90	50L6GT	0.90
6B8	0.93	6SK7	0.96	42	0.76

TYPE	PRICE
★	★
★ TYPE	PRICE ★
★ 5R4	$4.50 ★
★ 6C21	30.00 ★
★ 307A	2.75 ★
★ 357A	22.50 ★
★ 805	2.90 ★
★ 808	1.70 ★
★ 9308	3.90 ★
★ 9003	1.30 ★
★	★
★	★

This offer subject to change and prior sale.

SPECIAL SALE TYPE 805 OUR PRICE: $2.90 List Price: $13.50

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MANUFACTURERS AND DISTRIBUTORS OF ELECTRONIC PRODUCTS
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NORMAN RADIO DISTRIBUTORS INC.
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1 REL Model 600 FM Broadcast Modulation and Frequency Monitor
Like new. Frequency of monitor, 100.3 mc. Cost $750. Will sacrifice for $350. Contact: L. C. Sigmon.
KMPC
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D401	BD77	Dy22
DA1A	BD89	DA1F
Dm21	BDAR93	SP175
Dm 28	PE73	ML4520
DM 32	PE89	DA7A
Dm 33	PE101	651
Dm34	Pe94	D101
DM36	DM19	Dy82
Dm37	PE55	DA3A
Dm53	ML 3420	

And other numbers. (Send us the numbers you need. All types of DC motors, Generators.

Wanted DM32-35-36-40-41-42-43-53 Dynamotors. State quantity, condition & price. Need BC620-788 SCR 522. Units and component Parts also ART-13 equipment.

VETS. DIST. CO.
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Quantity	Gauge	Strip Width	Build Up	Window Width	Window Height
11,365	.003	1⅛	½	7/16	3
3,741	.003	⅞	⅜	7/16	3

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5..10..50 microamperes

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5 to 500 volts

Available in multiple range combinations

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Particularly items of good quality—Boonton, Ferris, L&N, G-R, etc.

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Approx. 9 cu. ft. plus or minus. Cold and Hot minus 65° F. to plus 125° F. with controls Indicators preferred.

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408 Atlantic Avenue, Brooklyn 17, N. Y.
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WE PAY TOP $$$$$$ FOR:

Radio Components	Wire & Cable
Instruments	Selsyns or Synchros
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Signal Corps Equipment	Transformers, Air Cooled
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Kindly send us your listing of materials available or place our name on your mailing list to receive any listings you may issue.

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PARTS

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DYNAMOTORS • SELSYNS • AUTOSYNS • INVERTERS • TRANSMITTERS
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Please send list stating condition and lowest price.
No Quantity Too Small or Too Large!
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QUARTZ CRYSTAL UNITS

in holders, FT-171; FT-241; FT-243; FT-500. Any quantity. Advise condition.

W-2217, Electronics
330 W. 42 St., New York 18, N. Y.

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EQUIPMENT WANTED!

We want to buy all types of surplus electronic equipment. We are one of the largest buyers in U. S. We buy more because we give every seller top prices and a fair deal. TELL US WHAT YOU HAVE. USE COUPON BELOW—*AND MAIL TODAY!*

Use following numbers to indicate conditions: N-1, brand new; N-2, used, like new; N-3, used.

ITEM	CONDITION	PRICE WANTED

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Address.....

SEE COLUMBIA ELECTRONICS AD ON PAGE 349

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Absolute top cash prices paid for new or surplus special purpose tubes and X'tal diodes. The following are urgently needed *immediately!* Any quantity, 1 to 3000.

2K25/723A/B: 393A: 1Q26: 1521: 2K39: 3C22: 3C45: 4C35: 4J52: 5C22: 5R4: 6AN5: 6AS7: 6J4: 6L6M: 83: 502A: 7268,C: 575A: 810: 2050: 5651: 5670: 569(2)(3): 5751. And many others.

If you have any merchandise that you think we would be interested in; write AT ONCE, enclosing *FULL DETAILS, TO:*

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ATTN: JOS. ANZINO
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WANTED

Sweep Radar Assembly Heavy type English design type 3107

Sweep Radar Beacon (English design) type Eureka II

Same as above (American type) AN:PPN2 Eureka II

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Additional Wanted Advertising on the opposite page

G.E. HEAT UNIT
Cap. 20 K.W.

Hi-Frequency Induction Model 4F20 for 3/60/220 Like New (1948) with work Table 2 positions.

Price . . . . $7,500—F.O.B. Bklyn.

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- electronic components,
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Any quantity of C6J or C16J Electronic Tubes as manufactured by Electronics, Inc., also Jones plugs Cat. Nos. P-506-SB, S-506-SB, P 3402-SB, S 3402-SB.
State quantities available and best price for each size. Reply to Box Number
W-2731, Electronics
330 W. 42 St., New York 18, N. Y.

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Physics Department
STATE UNIVERSITY OF IOWA
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Sell Your Surplus to Gould Green
We buy and sell every type of electronic material, including war surplus. Let us submit our bids for your surplus inventory; large or small quantities. When you buy from us you save plenty—here are a few of our bargains:
SOLDER 40/60, solid .080" dia.. Yellow Kester Label; 5 lb. spools @ ..... $1.50 lb.
SOLDER 50/50, rosin core, Red Kester Label, .030" dia. 5 lb. spools @ ..... $1.25 lb.
RESISTORS: precision wire-wound, Standard Rated (surplus) accuracy within 1%; small, compact (size of one and two watt carbon types), 2" pigtails, bakelite enclosed; excellent as standards; combined in series or parallel you get any ohmage wanted; 100 ohms and 1000 ohms in 10 megs; wonderful value at $10.00 per kit of 100 resistors (all different — think of it).
RESISTANCE WIRE: 2500 ohms per inch (30,000 ohms per ft.) Mfr. W. B.; a fine enamelled wire (.250 approx.) spirally wound on a flexible insulated core. Sold as they come in fractional lb. spools. Write for sample. Price..... $10 per lb.
RESISTORS: (Standard Brands) type AR 40 ohm-10 watt; type DJ 24 ohm-30 watt; price 15.00 per C; also, flat sand type 3500 ohm-10 watt; price, 12.00 per C. 500 ohm-30 watt. Fixed leads; price $5.00 per C.
CARBON (COMPOSITION) RESISTORS: we have surplus sizes & tolerances; new, standard brands; we may have the sizes & wattages you need; price, ½w. @ $24.75 per M for 10%. One watt, price, $35.50 per M for 10% tolerance. 5% is approx. $10.00 additional.
TUBULAR CONDENSERS STANDARD BRANDS: .01, 400 V., 100 for $3.85. .03 @ 400 V., $3.85 per C; .05 @ 200 V. $3.65 per C. Many other sizes—write for prices.
CONTROLS; quantities always available; inquiries solicited.
SPAGHETTI; many sizes & some colors in stock; we'll match your samples; price, $10 per M.
DRIVE SHAFTS for table radios; price, $21.50 per M; write for free sample.
TUBULAR 600 V. STANDARD BRAND; .0005 @ 600 V. pigtail; price, $42.50 per M. Also, type TIM, .005 @ 100 V. @ $5.25 per M.
SOCKETS; sub-miniature type (bearing aid), 5-prong, moulded (free sample); price $40.00 per M. Miniature 7-prong sockets, $38.00 per M. 9-prong @ $38.75 per M.
SWITCH; a water type mounted on "edge" with lever (rubber handle) for opening control; DPDT A three; price, $8.50 per C. Sample free.
BLINKER LIGHT; any voltage blinker light operated by two 67½ V. portable-type batteries; blinking as a warning signal intermittently. A resistance-condenser type switch determines the rate of blink. These lights, with fresh batteries, have been known to operate continuously 1 3/4 hrs. daily for two years. Size, 5½" x 5½" x 4½" with 2½" carrying handle; made of wood, army-green finish; Price, less batteries, 4 for $14.00.
STORAGE BATTERY; Willard, 4 volt—40 amp.; transparent plastic case, 5½" x 6½" x 9¾"; dry cousns ready-charged, dry—you add the water; built-in hydrometers; two cells. Ideal for burglar-fire alarms; auto-ignition system; interconm or private telephone and telegraph systems, etc. Wt. 8½ lbs.; packed 4 to carton. Price, 4 for $9.00.
CATHODE-RAY TUBES; 9LP7; 5CP1; 4AP10; 5BP4; limited qty; price, $45.00 ea.
TOGGLE SW.; 6 pt. aircraft type; 2PDT 5A; 5 amp @ 125 V.AC—35 amp @ 24 V. $19.00 per C.
SCREWS, EYELETS, RIVETS, WASHERS, SHAKE-PROOF WASHERS & TERMINALS are available in surplus lots; also, special screws and terminals. Inquiries solicited.
DYNAMOTOR; Alcor, large, wt. abt. 50 lbs. Brand new. Most D.C. input voltages available from 24 v. to 95 v.; output 6.6 v. at 15 amp.; 300 v. at 350 mils. Packed in wood cases (new); orig. cost $140.00; special price $25.00
Kilnot circuit breakers; 10 amp 2; RC-83G3; other sizes also; ea. ..... $2.00 per C
DYNAMOTOR; input 14 v. at 3 amp.; output 220 v. at .08 amp. 60 ~ $3.75
JAN TUBES; bulk packed; war surplus;

12SN7, Sylvania	70¢	7N7 Sylvania	70¢
6SN7 Kenrad	70¢	7C5 Sylvania	70¢
6SL7 Sylvania	85¢	954 Tungsol	30¢
12AL5 RCA boxed	70¢	2021 RCA amperex	45¢
6J5 RCA metal	54¢	471-B Nat. U.	41¢
6SG7 RCA metal	77¢	471-A amperex	41¢
6AC7 RCA	$1.00	800 RCA boxed	72¢
6AC7 Kenrad	85¢	1630 RCA boxed	95¢
7T4 Sylvania	85¢	6SF RCA boxed	99¢

RADIO AND TV TUBES; bulk and orig. boxes (see our terms):

6BG6 Syl. bulk	$1.00	Sylvania, Tungsol	
35Z5 Nat. Un. blk.	52¢	Sealed tubes, current	
6W4 Syl. & Tung.	61¢	dating at 50% off.	
6AT6 Syl. Blu.	72¢	Expired dating 50 and	
50L6 Syl. Blu.	73¢	75 off.	

TUBE CARTONS; white, folded with See.

Small or large peanut @	$1.00 per C.
GT @	1.00 per C.
Small G @	1.45
Large G @	1.60 per C.
Extra large (6¼") @	2.50 per C.

Bulstun Cond.; .25 x .25 MFD. @ 400 VDC, standard makes, @ 10¢ ea. Sample ea.
Bulbs (Jap 4 V.) 100 to the box. Very cheap at $4.25 per M. Free Sample.
LAMP; 18 candle pr.; 6-8 V.; single contact; Mazda GE #1817; 1¼" dia., 2¼" long; free sample; cartons of 400; price 400 for $9.00
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OIL FILLED & TRANSMITTING MICA TYPES
All Values and Voltage Ratings
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NOW IN STOCK
WESTON SENSITROL RELAYS Model 705, KS-7996. Calibrated 13-19 V. $12.50
RUNNING TIME METERS Sangamo Model 17, in hours and 1/10th hours to 9999.9, 440 V AC 60 Cycles $4.95
Variable RESET TIMERS Sangamo Model 21, open circuit from 0 in 3 minutes, calibrated in 5 second intervals. Will handle 10 amps or more 110/330 V AC 60 cycles. $4.95

CALCULOGRAPHS. These units compute elapsed time to 10 minutes in minutes and seconds, and print this elapsed time as well as time of day on a card (For example a card may show "start 9:55 AM" "Elapsed time 18 minutes, 51 seconds"). Any number of jobs may be run at the same time. Originally used to log long distance telephone calls. Dial type printing. Reconditioned. With 8 day "winding" movement $89.00
With 20V AC 60 cycle Movement $79.00

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PIONEER AUTOSYNS AY-30-D $35.00
BENDIX AMPLIFIER 12077-1-A $29.50
SELSYNS, 1F, 1CT, 1SF, 5F, 5G, 58F, 58G. Write for prices.

BEACHMASTER 250 Watt Audio Amplifier with bank of 9 35 watt speakers, cables, mike, tubes. Operates on 110 V AC 60 cycles. Like new $396.00
BEACHMASTER AMPLIFIERS are available as originally delivered to the Navy, with 1500 Watt gas engine driven generator & complete spares, all packed in 6 waterproof crates, all new $695

SUPERSONIC MODULATOR Mfgd by Doolittle for Navy Air Drawing # 58326-1, contains 11 tubes, 10 relays etc. for operation on 12 V Chass dirty, very clean inside. $14.95
SUPERSONIC SELECTOR Mfgd by Doolittle for Navy Air. Drawing # 2926-1, Contains 11 tubes, 10 relays etc. for operation on 12 V Chass dirty, dirty, very clean inside. $14.95

Laboratory PRECISION REGULATED RECTIFIER Type CEC-20AAG. Input 110 V AC 60 cycle, output adjustable from 250 to 500 VDC at 250 Mills. Contains 2-5U4G, 2-6SQ7 1-VR150-30, 1-VR-105-30, 4-6L6G. A special at $98.50

DYNAMOTORS

Type	Input Volts	Output Volts	Mils	Price
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DM-35	12	625	225	
DM-36	28	220	80	$.95
DM-37	28	625	225	11.50
DM-64	12	275	150	11.50
DM-65	12	400	440	22.50
BD-77	13	1000	350	28.00
TCS-Recvr.	13	225	150	11.50
TCS-Xmtr	13	400	440	22.50
TCS-Complete power supply, 110 VDC Input				44.50
ET-3012-D-230/MQ24				

BEARING DEVIATION INDICATOR Type CBM-55105. Mfgd by Sub Signal. $495.00
QBG-1 DRIVER RECEIVER Type CFF 43058. ..... $125.00
BC-348, RECEIVERS, Reconditioned. $149.50
RBL RECEIVERS Operate on 110V AC 60 Cycles, frequency range 15 Kc to 600 Kc. Reconditioned. $89.00
RNCA AR-8600X AUTO ALARM RECEIVER Complete, like new. $295.00
SM PORTABLE RADAR with all tubes, antenna rotor cases, loss antenna screen & tripod. . . $300.00
SF-1 RADAR Brand new with complete spares, waveguide, fittings, etc. 19 boxes. $3500.00
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ALLEN-BRADLEY Type B-300 starting relay DPST 440V AC 60 cycle. Excellent condition $3.00
TRANSFORMER 230-460 V 6U Cy in. 7.5 V 37A out, weight 7 lbs. $3.00 ea. **Special 100 for $125.00**
SOUND POWERED CHEST & HEADSETS, used operating RCA & Automatic Electric (large Headset) per pair. $12.50
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CD-183 ..... 10 for $17.00

TDE PRIMARY SHIP TRANSMITTERS. If band 300-1500 Kcs. H.F. band 1500-18100 Kcs. C.W. MCW & Phone. With internal M.G. for 115 VDC or 230 VDC. Fully reconditioned. $600.00

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Mackay 128-A 5.5 to 17 Mcs
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RMCA-8019 with 110 VAC power supply
TCP, TCb, TAY, and many others
Write for quotations on your requirements
TCP-2 Line Filter unit, CRM 53086 for use on 115 VDC, New $15.00
All prices FOB Oakland, Calif., subject to change without notice. Terms 20% cash with order, balance C.O.D.
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Amertran "TRANSTATS"

Voltage Regulator
11.5 KVA 50/60 cy. Commutator range 0-115 V. Max. Amps. 100. Reconnection diagram available for 230 V. 50 A operation $225.00

SUPERIOR POWERSTATS

Type 1156, Output 0-135V, 60 cy, 45A, 6.1 KVA $100.00
Type 1256, Output 0-270V, 60 cy, 28A, 7.5 KVA $100.00
Type 1256-2P, Output 0-270V, 60 cy, 56A, 15.1 KVA $225.00
Type 1126-3Y, Output 0-270V, 15A, 60 cy, 7.0 KVA $100.00
Type A2-LF Voltstats, Output 0-230V, 60 cy, 25A (LN) $75.00
Transtat .25 KVA. Fixed winding 115/1/60. Commutator range 103-126 V. Max AMPS. 2.17 .....$9.45
.5 KVA Fixed Winding 115/1/400 Commutator range 92-115 V Max Amps. 5.5 .....$4.50

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Elec Spec Type 1A1, Spec 32159D, 24VDC, 15A, ¼ HP, 3800RPM $22.50
Pump Eng Type 1454ME, 24VDC 95A, 4000RPM, 2.25HP $37.50
Holtzer Cabot Type RSD220, 24VDC, 8A, 1/3HP, 6000RPM $14.95
G. E. Mod #5BC21M36A, 24VDC, 60A, 3800RPM, 1¼HP $32.50
Oster Type D-4-2, 24VDC, 116HP, 1800RPM $9.95
Elcor ML2310-52, 24VDC, 0.32A, 1800RPM $4.95
Oster Type ES-2-1, motor for ¼ seisem $7.95
Universal Model 523, 115VDC, 2.5A, 5000RPM $5.95
Westinghouse Style 171391, 27VDC, ½HP, 6.5A, 5800RPM $14.95
Holtzer Cabot Type 2503, 115VAC, 60 cy, 3ph 9W, 1725RPM (LN) $45.00
Oster Motor, 6VDC, 1.8A, 5000RPM $6.95
W.E. #5K6603L01, 24-28VDC, 0.6A, 5000RPM, 1/100HP $4.95
Alliance Type 2207, 27.5VDC, 7500RPM, 1/100HP $8.95
Ostor Type C-2BP-1A, 27.5VDC, 7000RPM, 1/100HP $8.95
Lear Type C004, 24VDC, 1.5A, 8W, 7500RPM $6.95
EAD Type 131, 115VAC, 400Cy, 1/50HP $9.95
Lear Type 133A, 24VDC, 5.5A, 72W, 9000RPM $15.75
Barber Coleman #BYLC2190, 24VDC, 1A, Torque 100 in/lbs. 60 strokes, 6-7 sec $14.95
W.E. Mod 28944, 8 type 8D, 45/52V, 3.5A, 1765 RPM $15.25
W.E. Mod 24517, 230/200V 60cy or 45/52VDC 1/16 HP, 1725RPM $17.50
G.E. Mod 5BA10AJ22, 24VDC, 100 oz/in torque, 140RPM $14.95
G.E. Mod 5BA10AJ40, 24VDC, 10 oz/in torque, 140RPM $15.95
Emerson Style 161-0212, 24VDC, 160 oz/in torque, 100RPM $17.50
Westinghouse Type GN-WL33 Alternator, 12VDC @ 6.6A and 1.5VAC 0.1A 875-970 cycles $14.95
G.E. Generators Type BV, Model 5BY9E8, 140VDC, 0.025A 1800RPM, Perm Mag Wound $8.95
G.E. #2J1F1 Selsyen Generator $12.95
G.E. #2J1G1 Control Trans $12.95
G.E. #2J1H1 Selsyen Generator $12.95
G.E. #2J1D1 Selsyen Generator $12.95
G.E. #2J1F3 Selsyen Generator $12.95
Bendix Mkl Mod. 3 Step by Step Motor $14.95
Pioneer Magneesyn PR-51505-1-$320-1A $9.95
Pioneer Autosyn AY-26 .....$14.95
Pioneer Autosyn AY-14G $14.95
Pioneer Motor, 10047-2AG $14.95
Holtzer Cabot PM Mtr #2S3-RSD0006, 24VDC $14.95
Pioneer Autosyn AY-270DI $14.95
Pioneer Autosyn AY-59DI $12.95
Bendix Synchro Generator 1G $49.95
G. E. Selysen 21D561B1, 60 cy $19.95
Diehl Control Mtr. FPE-49-5 .....$52.50
Diehl Control Mtr. FPE-25-11 .....$39.50
Diehl Resolver, FPE-43-1 (used) $24.50
Modulator MD-7/ARC5 w/tubes & dyna $12.50
Rogers Switching Motor, Type 25, Ref #11OFB/31, 24VDC $8.95
American Blower w/G.E. mtr, 230VAC 50/60cy 1/3HP $49.50
EAD Blower & Mtr, 115VAC 400cy 110CFM $14.95
Redmond Blower & Mtr, 115VAC, 60cy 85CFM $14.95
Redmond Blower & Mtr, 24VDC, 1.35A 4750RPM Dual Output 100CFM (LN) $42.50
Dynamic Axial Flow Fan & Mtr, Mod 586-SCB4, 24-28VDC, ⅛ HP, 8000RPM, 325CFM @ 2"H20 (LN) $24.95
Westinghouse Blower & Mtr, Type FL, 115VAC 400cy, 6700RPM, 50CFM $8.95
F. A. Smith Model 69C Blower & Mtr, 115VAC 60cy 50CFM $9.95
Oster Blower & Mtr, Type C-2P-1L, 28VDC, 1/100HP 1.8A $12.50
Delco Motor, A-7155, 27VDC @2.4A 1/20HP 3600RPM $12.95
Elec Ind Mtr. Type 203, 115VAC, 60cy 1ph, 0.45A 1800RPM 1/75HP $14.50
Ohio Elec Type CP38220, 115VAC, 60 cy 1ph, 3400 RPM, 1/40HP $15.95
Diehl Mtr, C78291 & Delco C78889, 115VAC, 50/60cy, 3ph, 1/40HP (LN) $35.95
Delco Model A7501B Mtr, 24VDC, ¼HP 11A, 6000 RPM $17.50
Elcor, ML4629-43, 24VDC, 17A, 1/3HP 2800 RPM $22.50
Pioneer Type CK-2 Servo Motor, 28V 400cy fixed phase, var. phase 49V, 40:1 gear reduction $10.95
Pioneer 10047-2A Servo Motor, 2ph, 400cy, w/40:1 reduction gear $14.95
W. E. Sine Wave Motor Generator, KS-5013L02. Mtr 115V 60cy 1 ph 1/50hp 1725 RPM; Generator 16V 2ph 1725 RPM $17.95
Pioneer Gen-E-Meter, Input 18VDC; Output 450 VDC @ 150MA $4.95
D. C. Generator #CBF-21263A, Input 12.6V 0.36A; Output 500VDC @ 0.065A. Power drive speed 2100 RPM, Hand drive 50-70 RPM $14.95
PE-103A Dynamotors; Input 6-12VDC @ 21/11A; output 500V @ 0.15A, filtered w/cables $29.95
PE-103 Dynal motors: Same as above only w/o filter and cables $19.95
Sendix Generator Model 3975-1; Input 28VDC @ 0.175A, Output 300VDC @ 0.040A $3.95
PU-16/AP Inverters, Input 28VDC 60A; Output 115V 400cy 6.5A 8000 RPM 750VA $89.50
PU-7/AP Inverters, Input 28VDC 160A; Output 115V 21.6A 400cy 8000 RPM 2500VA $89.50
PE218 Inverters, Input 28VDC 100A; Output 115V 400cy 1500VA $29.95
PE100 Inverters, Input 13.5VDC 29A; Output 115V 400cy 1.5A 8000 RPM $59.95
MG149F Inverters, Input 28VDC; Output 500VA @ 115V 400cy 1ph & 250VA @ 26V 400cy 1ph....$89.95

HIGH VOLTAGE CAPACITORS

#18F289 rated dual 60 Mfd @ 2000 VDC.....$65.00
#PFD-40244G Paper rated 7.0 Mfd @ 4000 VDC $37.50
#19F210 rated 0.1 Mfd @ 6000 VDC, max amps 204 .....$37.50
#TK-60020 Paper rated 2.0 Mfd @ 6000 VDC.$27.50
Inertsen Type FL rated 0.275 Mfd @ 7500 VDC/section $16.50
#7520, Oil, rated Dual 1.0 Mfd 7500 VDC.....$27.50
#14F283 rated 4.5 Mfd @ 7500 VDC.....$65.50
#2C-21B1 Paper rated Dual 0.5 Mfd @ 9000 VDC $32.50
Inertsen type FL rated 1.0 Mfd @ 10,000 VDC $37.50
#14F13 rated 5.0 Mfd, 10,000 VDC.....$49.50
#26F88 rated 0.1 Mfd @ 12,000 VDC.....$9.95
#A7548, oil filled, rated Dual 0.25 Mfd @ 6000 VDC $27.50
#TK120060-1 Paper rated 0.65 Mfd @ 12,500 VDC $19.95
#15020, rated 0.25 Mfd @ 15,000 VDC.....$19.50
#14F63 rated 1.0 Mfd @ 15,000 VDC.....$45.00
#20020 rated 0.25 Mfd @ 20,000 VDC.....$27.50
#TK20002-2 Paper rated 0.25 Mfd @ 20,000 VDC $27.50
#14F64 rated 0.25 Mfd @ 20,000 VDC.....$29.95
#TK20006 Paper rated 0.5 Mfd @ 20,000 VDC $45.00
#14F23 rated 1.0 Mfd @ 20,000 VDC.....$69.50
#14F103 rated 0.5 Mfd @ 25,000 VDC.....$57.50
#TK25050 Paper rated 0.5 Mfd @ 25,000 VDC $57.50
Inertsen type FP rated 0.5 Mfd @ 25,000 VDC $57.50
#14F88 rated 0.75 Mfd @ 25,000 VDC.....$72.50
#14F59 rated 1.0 Mfd @ 25,000 VDC.....$82.50
#A6734 rated 1.0 Mfd @ 25,000 VDC.....$82.50
#14F72 rated 0.15 Mfd @ 65,000 VDC.....$57.50

TRANSFORMERS

G. E. #69G590. Pri: 6V 60cy; Sec: 450V, 3VA. $1.25
Raytheon UX6486A, Pri: 115V 400cy Sec: 5V @ 5A, 13.5KV Ins. $3.95
Raytheon UX7358, Pri: 115V 400cy; Sec: 1-6500 @ 0.005ADC 2XIND. $4.25
G. E. #6G450. Pri: 500/250V; Sec: 72.5V 52.5W, 1KV ins. $2.45
Raytheon UX7689A. Output. Pri: 3600 Ohms 70 MADC, Sec: 720 Ohms 0 MADC 1700TV $1.75
Stancor A3871 Modulation, for use w/6L6 (Class) A1. Pri: 4500 Ohms. Sec: 8500 Ohms.....$1.65
Stancor D12A3551, Pri: 120V 60 cy; Sec. #1:220V @ 50MA, Sec. #2.5 @ 6.5A; #3: 6.3V @ 2A, Sec. #4: 6.3V @ 1A. $3.25
Stancor Type C-1 Current Trans. Pri: 100V 25/600A, Sec: 5V @ 50VA, 5KV Ins. $17.50
G. E. #8G449. Pri: 200V 60 cy, Sec: 260VCT @ 150W. Pri Ind: 14H @ 0.022ADC; Sec Ind: 36.5H $2.50
W. E. #KS8606. Pri: 115V 60cy; Sec. #1: 1000VCT @ 177MA. Sec. #2: 6.5V @ 1A, Sec. #3: 5.3V @ 4A, Sec. #4: 2.5VCT @ 7.5A. $7.25
G. E. #8G457. Pri: 1/1.5/2.6/8/10V; Sec: 50-50 Volts 100 Watts $1.65
G. E. #K54J111 Output. Pri: 990 Ohms, Sec: 3650 Ohms. Pri Ind: 20H @ 0.01ADC 10V 60cy.....$2.50

HEAVY DUTY TRANSFORMERS

Moloney Elec. #REL10383. Pri: 115/230V, 50/60cy; Sec: 31000 Volts @ 300MA. Oil Filled. 14¾"W, 16"D, 20-¼"H exc of ins. $225.00
G. E. Cat. #79G365. Pri: 203.5V; Sec: 6.5VCT @ 250A, 50/60cy, 2.46KVA. Wt: 180 lbs. 9¼"x7¼" x9¾" $39.50
G. E. Cat. #7479972. Pri: 230/208V, 50/60cy; Sec: 2450/2330/2310V @ 1.16I/1.223/1.29A. 2.85KVA $45.95
G. E. Cat. #7471907. Pri: 215/430V, 50/60cy; Sec: 5VCT @ 30A, 8KV ins. $22.50
G. E. Cat. #7479971. Pri: 230/208V, 50/60cy; Sec: 1365/1300/1235V @ 0.539/0.555/0.595A. 0.735KVA $29.50
G. E. Cat. #7479965. Pri: 230V, 50/60cy, 3 ph; Sec: 16.4/8.2V @ 60A 1KVA $27.50
G. E. Cat. #7475695. Pri: 115V, 50/60cy; Sec: 3530/3720/3910V 1.31KVA, 2.5KV ins. $47.50

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Detects metallic objects (ferrous or non-ferrous) to a depth of approx. 6 ft. Find outboard motors on the bottom of lakes, locate underground piping, treasure, metallic fragments in lumber, etc. New, complete with inst. book. $65.00. Used but like new $43.00

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Mfd. by G.E. Model 5KTYD33, 0-10,000 hrs. by tenths. 115V. 60 cy, 3" sq.....$14.95
Mfd. by G.E. Model 5KTYG60. 0-10,000 hrs. by tenths. 115 V., 60 cy.....$14.50

GP-7 Radio Xmtr, Complete w/6 Tuning Units & all accessories. Freq. Range: 350-9050 Kcs. Tube Complement: (1) 803, (1) 801, (1) 845, (1) 832, (2) 1616 and a full set of spares. 100W output. Brand New export boxed. Gross Wt. 450 Lbs. $149.50

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Complete power plant, with automatic distress signal gear train. Model 3975-1 Dynamotor rated 28VDC @ 0.175A. Output 300VDC @ 0.04A. Sockets, plugs, the relay, capacitors, etc., worth the money....$1.95
G.E. Cooper Hewitt Lamps, Type HTS.....$3.95
G.E. Cooper Hewitt Lamps, Type ATS.....$3.95
G.E. Cooper Hewitt Lamps, Type TU.....$3.95
Murdock Elec. KE-Switch, Cat. #A394. Double Throw, No Fuse, 100A, 250V.....$3.95
Test Panel, Mfd. by Pelham Elec. 24"W 6"H. 1" bakelite on channel uprights. Complete w/3 test meters 4" sq. (1) 0-15ADC, (1) 0-30/300VDC, (1) 0-30/150ADC. Three knife switches DPST for test of 20/115 or 230 supply. Each line fused. Receptacles for lamp test and fuse test, continuity test. Lamp bank $49.95
Resistor Bank #CR-9133-7117910. Consists of 3 ribbon-wound resistors 2.3 Ohms 1500W each. Can be used in series or parallel. 10⅛"W x 18⅛"L x 4¼"H $9.50
Sola Constant Voltage Trans. Cat. #30531. Type CVH. Pri: 190-250 Volts, 60cy 1 ph; Sec: 230 Volts 2.07A 477VA $48.50
Sola Constant Voltage Trans. Type 4. Pri: 95-130V 60cy; Sec: 115V 2000VA (LN) $125.00
Thordarson Modulation Trans. Type T47420A. Pri: 1500-750 Ohm. D.R. level 250W. Ratio: 1 to 2.35-3.37. Cycles per sec: 90 to 20,000. 13-⅛"L x 9¼"H, 7⅛"W $19.95

CHOKES AND REACTORS

G.E. #7475694 rated 10H @ 0.65ADC, 2KV test $22.50
Raytheon UX-9114A rated 0.100H @ 1.4ADC, 1780 VT $3.00
Raytheon UX-9116 rated 0.030H @ 2.0ADC, 1780 VT $4.95
G.E. #7479973 rated 2.5H @ 3.5ADC, 7KV test $46.95
G.E. #7479964 rated dual 50H @ 0.035ADC each sec, 58 Ohms D.C. res, 15-30,000cys.....$27.50
G.E. #7469170 rated 6H @ 3.2ADC $22.50
Raytheon #CRP-30509 dual. Sec. #1 rated 1.5H @ 0.384ADC, Sec. #2 rated 0.7H @ 0.384ADC, 1780 TV $4.25
Raytheon #WX-5149 Dual. Each section rated 1.75H @ 0.25ADC, 42 Ohms DC res. each sec., 1780TV $3.50
G.E. Type K, Form FB. Rated 175.8H @ 0.0673ADC 7KV ins. $38.95
G.E. Type K, Form HB. Rated 37H @ 0.10ADC 14KV ins. $27.50
Amertran Type ELS. Class: Swing, 7.5KV ins. 6H @ .145ADC; 2H @ 0.145ADC, 120cy ripple..$29.95
Raytheon UI1010 Rated 10H @ 1.2ADC 5KV.$49.95
Industrial #CK3016 Rated 20H @ 60MADC. $2.95
Amertran Type W. Class: Audio. Rated 1H @ 0.800ADC 15KV ins. $27.50

PULSE NETWORKS AND TRANSFORMERS

Sprague #7.5-E4-16-60-67-P, 7.5KV, "E" Circuit, 4 sections, 16 Microsec. 60 PPS, 67 Ohms Imped. $7.95
Sprague #7.5-E2-3-200-67-P, 7.5KV, "E" Circuit, 3 Microsec. 200 PPS, 67 Ohms Imped. 3 sections $6.75
Sprague #8-E5-1-1000-50P, 8KV, "E" Circuit, 1 Microsec. 1000 PPS, 50 Ohms Imped. 5 sections $22.50
Sprague #10-E3-0.5-3000-50P, 10KV, "E" Circuit, 3 sections, 0.5 Microsec. 2000 PPS, 50 Ohms Imped $29.95
Sprague #15-A-1-400-50P, 15KV, "A" Circuit, 1 section, 1 Microsec. 400 PPS, 50 Ohms Imped. $17.50
Sprague #15-E4-0.91-400-50P, 15KV, "E" Circuit, 4 sections, 0.91 Microsec. 400 PPS, 50 Ohms Imped. $19.95
Fast #15-FS-1.33-700-50P2T, 15KV, "F" Circuit, 5 sections, 1.33 Microsec. 700 PPS, 50 Ohms Imped $29.50
W.E. #D-163330 Network Assy, 3 retard coils & 3 cond in oil filled rect. case, 530 Ohms, 1 Microsec. $22.50
Raytheon Pulse Trans. Type WX-5137. Pri: 4KV, 1 Mu. Sec., Sec: 16KV 16A. $9.75
Raytheon Pulse Inversion Trans. Type UX-8442 —40V +40V $6.75

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25 Watts, Fixed, 500 Ohms.....39¢
25 Watts, Adjustable. Choice: 15, 115, 1350 Ohms 39¢
25 Watts, Multi-Tapped. Choice: 0.5CT, 400 & 11K Ohms.....25¢
40 Watts, Fixed. Choice: 20, 5000, 100K Ohms. 40¢
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50 Watts, Adjustable. Choice: 25, 50, 125, 200, 1250, 5500 Ohms.....99¢
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100 Watts, W-L Rib-Flex. Choice: 0.42, 0.54, 0.68, 0.8, 0.9, 1.1, 1.2, 1.3, 1.4, 3.8, 4 Ohms.....95¢
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Type D10Wi, Vitreous Gray Porcelain 10 Ohms Adjustable, 150 Watts. Export Packed 4 per carton.....$1.50 ea 4/$5.99
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Heavy Duty Air-Cooled Resistors, Leading Mfd. 1500 Watts, Your Choice of Following Resistances: 1.3 Ohms, 3.5 Ohms, 1.6 Ohms, 25 Ohms, 0.5 Ohms, 0.16 Ohms.....$8.75 ea

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Type 2003-29: A to B—12.8 Ohms, D to M—1.67 Ohms, C to M—800 Ohms.
Type 2000-36: A to B—71123 Ohms, B to D—0 Ohms, C to D—71123 Ohms, ± 0.1%
Type 2000-40: A to B—14300 Ohms, C to D—14300 Ohms ± 0.5%
Type 2000-58: A to M—100K Ohms ± 0.2%, A to M—100K Ohms ± 0.2%, D to M—22870 Ohms ± 0.1%
Type 2000-70: A to B—4600 Ohms, C to D—4600 Ohms ± 2%
Type 2000-71: A to B—798300 Ohms, C to D—850000 Ohms ± 1%
Type 2000-72: A to B—0.32 Ohms, C to D—1.30 Ohms ± 5%
Type 2000-76: A to B—8333 Ohms, B to C—667 Ohms, C to D—417 Ohms ± 0.2%
Type 2000-82: A to B—817K Ohms, B to C—36600 Ohms, C to D—81700 Ohms ± 0.1%
Type 2000-84: A to B—800K Ohms ± 0.5%
Type 2000-85: A to B—786K Ohms, B to C—831500 Ohms ± 0.5%
Type 2000-111: A to B—54711 Ohms, C to D—37400 Ohms ± 0.3%
Type 2000-148: A to B—133440 Ohms, C to D—118336 Ohms ± 0.1%
Type 2000-150: A to B—731700 Ohms, C to D—850K Ohms ± 0.1%
Type 2000-155: A to B—223580 Ohms, B to C—233380 Ohms, B to D—4144 Ohms ± 0.2%
Type 2000-156: A to B—133440 Ohms, B to C—100K Ohms, B to D—70974 Ohms ± 0.1%
Type 2000-160: A to B—53464 Ohms ± 0.1%, B to C—4.29-1 Ohms ± 0.2%
Type 2000-169: A to B—341200 Ohms, C to M—107019 Ohms, C to D—184770 Ohms ± 0.1%
Type 2000-170: A to B—13344 Ohms, B to C—46777 Ohms ± 0.1%
Type 2000-175: A to B—816960 Ohms, B to C—216960 Ohms, B to D—11704 Ohms ± 0.2%
Type 2000-176: A to B—133440 Ohms, B to C—100K Ohms, C to D—64354 Ohms ± 0.1%
Type 2000-179: A to B—500K Ohms, B to M—6218 Ohms, C to M—24790 Ohms, D to M—15240 Ohms ± 0.5%
Type 2000-184: B to M—0 Ohms, A to B—324090 Ohms, C to M—324090 Ohms, D to M—102500 Ohms ± 0.1%
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EQUIPMENT SPECIALS

Converter & Range Plan Position Indicator Type CRM-55ACW, P/o SF Radar equip. Complete with tubes and parts. (LN).....$125.00
AS-5/APS-2 Antenna Unit. Complete with motor.....$95.95
R-31/APS-2E Indicator Unit. Complete with meters, tubes, motors, etc.....$125.00
TCC-1 Radio Transmitter Equip. Xmtr-Rectifier Unit Type CAY-52151 w/plug-in tuning units. 350 to 9050KCS. Output 125 Watts. (LN).....$89.95
Spare Plug-in Units for above Xmtrs. (LN).....$3.95
Radar Transmitter Type CBM-43ABT, p/o SF Radar equip. Complete (LN).....$69.50
NF2-14 Noise Filters. Mallory. 25 Amps 35 Volts.....$1.75
M300 Inserts for HS30U Headsets.....$4.00/c
W.E. Type 716E Headphones. Magnetic, 275 Ohm Imped. 1000 cycles.....$3.95
F28 Field Telephones, complete (LN) per pr..$34.95
T17 Shure Microphones w/plug. (LN).....$4.95
HS30 Headsets w/transformer & plug.....$2.35
HS30 Headsets w/o transformer.....$1.95
T45 Lip-Microphones.....89¢
T26 Chest Sets with headphones (LN).....$2.35
E5750 Headsets.....$4.95
TBY Transmitter-Receiver. 28-80MC. Complete w/ 5000KC Xtal & tubes.....$39.95
Transmitter BC-AB200. Less tuning units & tubes.....$3.95
PR112A Power Rectifier with dynamotor.....$7.95
BC-AN-430 Xmtr w/tubes less tuning units (LN).....$4.95
BC-AN-429 Receiver w/tubes less tuning units (LN).....$3.95
BC-AS-229 Receiver w/tubes less tuning units (LN).....$3.95
Westinghouse Negative Sequence Filter Style N636586 for type HQS relay, 3 phase output, 5 amps 50/60cy. Westchse Ground Fault Phase Selector Relay Type HQS Style N636585. Westinghouse PS Relay Style N636664. These 3 units make up the type HQS Phase Selector Relay Sets used for Selective-Pole Carrier Relaying. Complete.....$95.00
G11A Solenoid. Mfd. by Magnavox Co. 24VDC...98¢
G.E. Voltage Regulator Model 3GVD11B6, 115V 60cy supply, 23-35KV. Complete with 10 tubes. 183" x 12½" x 8¾".....$49.95
217/ARC-5 Junction Boxes, 28VDC (LN).....$1.25
RT-7/APN1 Radio Xmtr & Receiver w/tubes (LN).....$3.95
Raytheon Line Voltage Regulator type CRP301407 Pri: 92-138 Volts 57-63 cycles, 15 Amps, 1ph; Sec: 115 Volts 7.15 Amps. 0.82 KVA, 98% PF, 31°H, 167D, 194°W.....$97.50
TP-89OD McElroy Tape Puller w/115V 60cy motor, speed regulator.....$29.95
BC604D Xmtr w/meter, tubes, and crystals (LN).....$34.50
AM-6/APA-1 Video Test Set.....$14.95
I-115 Western Electric Test Set.....$9.50
Shunts R. F. Co. Cat. R-9 3 Milliohm, 1000MA...59¢
Hammarlund R. F. Choke RFC-250.....98¢
BC-375E Xmtr. Comp. w/tuning units.....$80.00
Jack Box BC-1366.....39¢
MT/ARC5 Mounting Base f/ATA or ARC5 equip $1.00
Daven Sound Attenuators, Type 350A, ladder network, linear, 50/30 Ohms imped. 2DB attenuation, 100F.....$3.98
Westinghouse Watthour Meters Type CS, 120V 60cy 1ph 15A, 2 wire.....$9.50

RELAYS

Auto Elec. R45H, 6500 Ohm, 2MA, SPST, NO.....$1.45
Auto Elec. R45, 6500 Ohm, 2MA, SPST, NC, & SPST, NO Simul.....$1.95
Guardian G39327, 6VAC, SPDT & SPST — NO Simul.....$1.95
Struthers-Dunn AD8T8, 6VAC, DPST, 30A.....$2.95
Edison Thermal 184808, 6V AC-DC, SPST-NC.....$1.95
Allied FX-31A, 6VDC, SPDT, 2A.....$2.25
Allied POX 86, 6VDC, DPDT, 15A.....$4.95
RBM #50118472, 6VDC, SPST-NO, 5A.....$1.95
RBM #5608-10, 6VDC, SPST, double break.....$1.45
Allied BO6D29, 6VDC, DPDT, 15A.....$3.95
G.M. #127700, 6VDC, SPST-NO, 200MA.....$1.95
Struthers-Dunn 8XAX100, 18VAC, SPDT, 8A.....$2.95
Auto Elec. R45P, 24VAC, SPST-NC & SPST-NO.....$1.95
Auto Elec. R-30, 28-30VDC, SPST-NO & DPDT.....$2.95
Clare 1058C, 12-24VDC, DPST-NO & SPST-NC.....$1.75
G.E. CR2791-B108C20, 12-24VDC, DPDT, 10A.....$1.75
G.M. #13020, 18-24VDC, DPST-NO & SPST-NC.....$1.75
Leach 1054ARW, 22-30VDC, DPDT & SPST-NO, 15A.....$2.25
Henry #1010 Min., 24VDC, SPST-NC.....$1.35
Allied BO13D35, 24VDC, SPST-NO, double break, 15A.....$2.95
Allied ER691526, Min. 24VDC, DPDT, 3A.....$1.35
Allied 452-11272, 24VDC, SPDT, 3A.....$1.65
G.E. CR2791-G1010F2, 24VDC, DPDT, 5A.....$1.95
G.E. 55836, 24VDC, DPST, 6A, Min.....$1.95
G.M. #13013, 24VDC, SPDT, double break, 15A.....$1.95
G.E. 3GTR72F4, 24VDC, SPST, double break, 300A.....$4.95
G.E. CR2791-D101F3, 24VDC, DPDT, 10A.....$2.25
Allied BO14D35, 24VDC, SPST-NC, double break, 15A.....$2.95
G.E. E55857, 24VDC, SPST-NO, double break, 2A.....$1.95
Sperry E1A29248, 24VDC, DPST-NO, 2A.....$1.75
Leach 1222DED, 24VDC, SPDT, 8A.....$1.95
G.E. CR2791-B100F3, 24VDC, DPDT, 15A.....$2.25
G.E. #55251, 24VDC, SPST-NO, 6A, Min.....$1.75
Allied #1074, 24VDC, DPST-NO, 15A, Ceramic.$3.25
Allied BO15D35, 24VDC, SPDT, double break, 15A.....$2.95
Allied BO6D35, 24VDC, DPDT, 10A.....$2.25
Allied BN18D33, 24VDC, 3PDT, 10A.....$2.95
Allen Bradley X95545, Type B6B, 24VDC, SPST-NO double break, 200A.....$2.95
Allen Bradley X99309, Type B4B, 24VDC, SPST-NO double make/break, 200A.....$3.95
Allied BOX48, 24VDC, SPST, double break.....$2.95
Price Bros. #311, 28-32VDC, DPDT, rotary.....$2.95
Square D, Class 8200, ARO-30, 110VAC 60cy, 3PST, double make NO double break, 15A.....$9.95
Cramer Type TEC, Adjustable timer, 115VAC, 0-5 min.....$12.50
W-L Type N83, 115VAC, 60cy., SPST-NO & SPST-NC, 15A.....$9.95
Westinghouse #1162956, 115V, 60cy, DPDT, 10A $9.95
Struthers-Dunn 1BXX54, 115VAC, 60cy, DPST-NO, 1A.....$3.95
W-L #4566297, 115VAC 60cy, DPST-NO, 25A. $7.50
Allied BOHX-P4, 115VAC 60cy, DPDT, 10A.....$3.25
Edison Type 501, 115VAC-DC, SPST-NO, Thermal, 5 sec.....$1.95
Edison Type 501, 115VAC-DC, SPST-NO, Thermal, 45 sec.....$1.95
Struthers-Dunn TD74A, Thermal, 115V, 60cy, SPDT, 30 sec.....$2.95
Struthers-Dunn Thermal, PVA3, 115V, 60cy, SPST-NO, 1 min.....$2.95

CIRCUIT BREAKERS

Heineman Type ANT44, Cat. #PAM151ORWM, 24 VDC, 0.220 Amperes, SPST.....$1.25
Heineman Type CB-193B, 110V 60cy, 1.25 Amperes, Curve 3, DPST.....$2.25
Heineman #CB193B-20C2534, 115VAC 60cy, 4 Amperes, Curve 1, DPST.....$2.95
Westinghouse, 115VAC 60cy, 15 Amperes DPST (LN).....$3.95
Heineman Type 0711, 110V 60cy, 15 Amperes Curve UN-2000, SPST.....$4.95
Westinghouse #WEP-3901C, 125VAC 60cy, 15 Amperes, SPDT (LN).....$3.95
Heineman Type 0322-M15, 24VDC, 15 Amperes Curve D, DPDT.....$3.95
G.E. Type AF1, 125VAC 60cy, 15 Amperes SPST $4.95
Adams Electric Thermag, 120VAC 60cy, 15 Amperes, SPST.....$4.95
Adams Electric Thermag, 120VAC 60cy, 20 Amperes, SPST.....$5.25
Westinghouse #417F, 125VAC 60cy, 20 Amperes, SPST (LN).....$4.95
Adams Electric Thermag, 120VAC 60cy, 25 Amperes, SPST.....$5.95
Heineman #0322, 230VAC 60cy, 25 Amperes Curve A, DPST.....$8.75
Heineman #0111, 115VAC 60cy, 30 Amperes Curve 2, SPST.....$7.75
G.E. Type AF-1, 230VAC 60cy, 35 Amperes DPST.....$9.95
G.E. Type AF-1, 230VAC 60cy, 50 Amperes DPST.....$12.50
Heineman #0322, 115VAC 60cy, 50 Amperes Curve UN-2000, SPST.....$12.50
G.E. Type AF-1, 125-250VDC, 70 Amperes SPST.....$17.95

INSULATED TUBING

Size	I.D.	Color	Type	Per 100'	Per M'
	.015⅝"	Green	Var. Cam.	$1.75	$11.50
	.0156	Black	Extr. Plas.	.75	5.40
20	.034	Black	Var. Cam.	1.75	13.50
20	.034	Yellow	Tri. Sat. Glass	3.75	32.50
20	.034	Brown	Tri. Sat. Glass	3.75	32.50
14	.072	Black	Var. Cam.	2.10	17.50
12	.089	Black	Sat. Glass	1.50	7.50
12	.089	Orange	Extr. Plas.	.75	42.50
12	.089	Green	Var. Cam.	2.20	18.00
12	.089	Black	Var. Cam.	2.20	18.00
11	.101	Black	Extr. Plas.	1.50	7.50
11	.101	Black	Var. Cam.	2.25	21.00
11	.101	Black	Sat. Glass	1.80	48.00
11	.101	Yellow	Sat. Glass	1.80	48.00
11	.101	Brown	Dbl. Sat. Glass	7.50	60.00
10	.112	Black	Var. Cam.	2.75	21.50
9	.124	Black	Var. Cam.	3.00	26.00
9	.141	Black	Var. Cam.	3.15	27.00
8	.141	Black	Extr. Plas.	1.20	10.50
8	.141	Clear	Extr. Plas.	1.20	10.50
8	.141	Yellow	Cal. Extr.	3.15	30.00
7	.158	Black	Var. Cam.	3.15	30.00
6	.170	Black	Sat. Glass	6.15	57.50
6	.170	Clear	Extr. Plas.	1.35	12.50
6	.170	Orange	Var. Cam.	1.35	12.50
6	.170	White	Extr. Plas.	1.35	12.50
6	.170	Black	Var. Cam.	3.00	14.00
5	.190	Black	Var. Cam.	3.00	14.00
5	.190	Black	Extr. Plas.	1.35	14.50
5	.190	White	Extr. Plas.	1.35	14.50
4	.224	Clear	Extr. Plas.	2.00	18.50
4	.224	Black	Sat. Glass	7.50	64.00
3	.249	Black	Extr. Plas.	2.25	18.50
3	.249	Black	Tri. Sat. V. C.	8.25	48.50
3	.249	White	Extr. Plas.	2.25	18.50
3	.249	Black	Sat. Glass	6.85	61.00
2	.278	Clear	Extr. Plas.	2.45	22.50
2	.278	Black	Var. Cam.	4.15	37.50
1	.299	Clear	Extr. Plas.	2.60	25.00
5/16"	.3125	Clear	Extr. Plas.	3.10	27.00
5/16"	.3125	Black	Neo. Hose	10.00	
0	.347	Yellow	Var. Cam.	6.40	62.00
0	.347	Black	Var. Cam.	6.40	62.00
3/8"	.375	Black	Dbl. Sat. V. C.	6.85	61.00
3/8"	.375	Black	Extr. Plas.	3.00	27.00
3/8"	.375	Yellow	Var. Cam.	8.00	76.00
3/8"	.375	Black	Sat. Glass	8.00	83.00
3/8"	.375	Black	Var. Cam.	8.00	83.00
7/16"	.438	Black	Extr. Plas.	4.00	36.00
7/16"	.438	White	Extr. Plas.	4.00	36.00
15/32"	.469	Clear	Extr. Plas.	4.50	42.00
7/8"	1.000	Black	Extr. Plas.	6.50	60.00
5/8"	.625	Clear	Extr. Plas.	6.50	64.00
11/16"	.688	Black	Extr. Plas.	8.75	
3/4"	.750	Clear	Extr. Plas.	8.50	
13/16"	.813	Clear	Extr. Plas.	10.00	
7/8"	.875	Black	Extr. Plas.	12.50	
7/8"	.875	Clear	Extr. Plas.	12.50	
1"	1.000	Clear	Extr. Plas.	15.00	
1"	1.000	Black	Extr. Plas.	15.00	
1-1/8"	1.125	Black	Extr. Plas.	17.50	
1-1/8"	1.125	Clear	Extr. Plas.	17.50	
1-1/4"	1.250	Black	Extr. Plas.	20.00	

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1.7	784	1385	3750	18850	145000
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1.93	1.6	1546	4314	21500	180200
1.925	1.8	1650	4444	22500	1750000
1.95	1.9	1667	4500	23000	1800000
1.96	1.91	1690	4700	23000	1850000
1.97	1.92	1700	4750	23077	1900000
1.98	1.93	1712	4750	23333	1950000
1.99	1.94	1740	4850	23400	2000000
1.99	1.95	1742	4860	23500	2050000
10.38	1.96	1800	4900	24000	2100000
2.35	1.97	1818	4900	24000	2150000
2.12	1.98	1820	5100	24000	2200000
2.13	1.99	1830	5100	24000	2250000
2.14	1.9%	1900	5125	24000	2300000
14.25	1.97	1852	5270	25833	2350000
2.15	1.98	1862	5270	25833	2400000
2.16	1.99	1875	5300	26500	2450000
2.17	1.9%	1880	5360	26500	2500000
2.18	1.9%	1887	5700	27000	2550000
2.19	1.9%	1897	5730	27000	2600000
2.2	1.9%	1900	5750	27000	2650000
10.2	1.9%	1905	5810	28500	2700000
2.21	1.9%	1900	6000	28500	2750000
2.22	1.9%	1900	6000	28500	2800000
2.23	1.9%	1902	6125	29000	2850000
2.24	1.9%	1903	6125	29000	2900000
2.25	1.9%	1904	6250	29000	2950000
2.26	1.9%	1905	6250	29000	3000000
2.27	1.9%	1906	6250	29000	3050000
2.28	1.9%	1908	6495	31000	3100000
2.29	1.9%	1907	6500	31000	3150000
2.3	1.9%	1908	6500	31000	3200000
2.31	1.9%	1909	6840	33000	3250000
2.32	1.9%	1910	6840	33000	3300000
2.33	1.9%	1911	7000	33000	3350000
2.34	1.9%	1912	7000	33000	3400000
11.75	1.9%	1913	7320	35140	3450000
2.35	1.9%	1914	7700	38500	3500000
11.7	1.9%	1915	7700	38500	3550000
2.4	1.9%	1916	7900	38500	3600000
2.41	1.9%	1917	7900	38500	3650000
2.42	1.9%	1918	7935	41400	3700000
2.43	1.9%	1919	7935	41400	3750000
11.2	1.9%	1920	10000	50000	3800000
2.44	1.9%	1940	10000	50000	3850000
2.45	1.9%	1947	10430	51430	3900000
2.46	1.9%	1950	10430	51430	3950000
11.5	1.9%	2200	10600	44000	4000000
2.47	1.9%	2200	10600	44000	4050000
2.48	1.9%	2200	10600	44000	4100000
2.49	1.9%	2200	10600	44000	4150000
2.5	1.9%	2200	10600	44000	4200000
2.51	1.9%	2200	10600	44000	4250000
2.52	1.9%	2200	10600	44000	4300000
2.53	1.9%	2200	10600	44000	4350000
2.54	1.9%	2200	10600	44000	4400000
2.55	1.9%	2200	10600	44000	4450000
2.56	1.9%	2200	10600	44000	4500000
2.57	1.9%	2200	10600	44000	4550000
2.58	1.9%	2200	10600	44000	4600000
2.59	1.9%	2200	10600	44000	4650000
2.6	1.9%	2200	10600	44000	4700000
2.61	1.9%	2200	10600	44000	4750000
2.62	1.9%	2200	10600	44000	4800000
2.63	1.9%	2200	10600	44000	4850000
2.64	1.9%	2200	10600	44000	4900000
2.65	1.9%	2200	10600	44000	4950000
2.66	1.9%	2200	10600	44000	5000000
2.67	1.9%	2200	10600	44000	5050000
2.68	1.9%	2200	10600	44000	5100000
2.69	1.9%	2200	10600	44000	5150000
2.7	1.9%	2200	10600	44000	5200000
2.71	1.9%	2200	10600	44000	5250000
2.72	1.9%	2200	10600	44000	5300000
2.73	1.9%	2200	10600	44000	5350000
2.74	1.9%	2200	10600	44000	5400000
2.75	1.9%	2200	10600	44000	5450000
2.76	1.9%	2200	10600	44000	5500000
2.77	1.9%	2200	10600	44000	5550000
2.78	1.9%	2200	10600	44000	5600000
2.79	1.9%	2200	10600	44000	5650000
2.8	1.9%	2200	10600	44000	5700000
2.81	1.9%	2200	10600	44000	5750000
2.82	1.9%	2200	10600	44000	5800000
2.83	1.9%	2200	10600	44000	5850000
2.84	1.9%	2200	10600	44000	5900000
2.85	1.9%	2200	10600	44000	5950000
2.86	1.9%	2200	10600	44000	6000000
2.87	1.9%	2200	10600	44000	6050000
2.88	1.9%	2200	10600	44000	6100000
2.89	1.9%	2200	10600	44000	6150000
2.9	1.9%	2200	10600	44000	6200000
2.91	1.9%	2200	10600	44000	6250000
2.92	1.9%	2200	10600	44000	6300000
2.93	1.9%	2200	10600	44000	6350000
2.94	1.9%	2200	10600	44000	6400000
2.95	1.9%	2200	10600	44000	6450000
2.96	1.9%	2200	10600	44000	6500000
2.97	1.9%	2200	10600	44000	6550000
2.98	1.9%	2200	10600	44000	6600000
2.99	1.9%	2200	10600	44000	6650000
2.9%	1.9%	2200	10600	44000	6700000
2.9%	1.9%	2200	10600	44000	6750000
2.9%	1.9%	2200	10600	44000	6800000
2.9%	1.9%	2200	10600	44000	6850000
2.9%	1.9%	2200	10600	44000	6900000
2.9%	1.9%	2200	10600	44000	6950000
2.9%	1.9%	2200	10600	44000	7000000
2.9%	1.9%	2200	10600	44000	7050000
2.9%	1.9%	2200	10600	44000	7100000
2.9%	1.9%	2200	10600	44000	7150000
2.9%	1.9%	2200	10600	44000	7200000
2.9%	1.9%	2200	10600	44000	7250000
2.9%	1.9%	2200	10600	44000	7300000
2.9%	1.9%	2200	10600	44000	7350000
2.9%	1.9%	2200	10600	44000	7400000
2.9%	1.9%	2200	10600	44000	7450000
2.9%	1.9%	2200	10600	44000	7500000
2.9%	1.9%	2200	10600	44000	7550000
2.9%	1.9%	2200	10600	44000	7600000
2.9%	1.9%	2200	10600	44000	7650000
2.9%	1.9%	2200	10600	44000	7700000
2.9%	1.9%	2200	10600	44000	7750000
2.9%	1.9%	2200	10600	44000	7800000
2.9%	1.9%	2200	10600	44000	7850000
2.9%	1.9%	2200	10600	44000	7900000
2.9%	1.9%	2200	10600	44000	7950000
2.9%	1.9%	2200	10600	44000	8000000

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1	1.57	2.5	3.73	6	8.02
1.1	1.61	2.6	3.75	6.2	8.2
1.21	1.65	2.7	4	6.5	8.25
1.25	1.78	2.75	4.5	6.7	9
1.3	1.8	2.8	4.22	7	10
1.4	1.9	2.85	4.32	7.2	11.85
1.5	2	3	4.5	7.5	12
1.52	2.11	3.3	5	7.72	12.83
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S. 4-pin AMPH49RS54 & mtg ..... .10
T. OCTAL 8-pin & plate Steatite ..... .25
U. OCTAL 8-pin & plate Steatite ..... .23
V. OCTAL 8-pin & plate Mica "B ..... .11
W. LOKTAL 8-pin & lock Mica "B HF ..... .30
X. KLYSTRON socket Cinch ..... .75
Y. LOKTAL Amph 49SL Steatite ..... .30
Z. OCTAL Amph 78S8 mica Bakte ..... .16
AA. 11-pin 78S11/93L Amph ..... .16
BB. OCTAL Amph 49S8S steatite ..... .25
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36	28	1.2	2.75
36	28	2	3.75
36	28	4	7.00
36	28	8	9.95
36	28	12	12.00
36	28	24	27.00

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Full Wave Bridge Selen for relays or Pwr. Inpt 115 to 130 vac; Outpt 115vdc/40ma Ea. 6¢; 10 for $5.98

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.1	50vdc	.15	.73	.05	12500vdc
.2	.10	.2	.73	.02	2.98
.1	150vdc	.1	1.98	.1	12500vdc
1-1.5	.10	.25	1.98	.05	4.98
.1	250vdc	.5	1.98	.01	15000vdc
2x.25	.35	.15	4.98	.0016	7.98
.1	300vdc	.1	1400vdc	.25	15000vdc
.1	.10	.25	.98	.0028	7.98
.1	400vdc	.1	1.98	.1	20000vdc
.1	.10	.5	1.98	AC RATED	
.25	.10	.9	1.98	220vac	600vdc
.5	.10	.1	2.98	.1	.98
.1	.10	.5	2.98	.2	.98
.1	.10	.1	3.98	.5	.98
.2	.10	.25	3.98	2	1.98
.5	.10	.5	3.98	4	1.98
.1	.10	.1	4.98	8	2.98
.2	.10	.25	4.98	10	3.98
.5	.10	.5	4.98	440vac	600vdc
.1	.10	.1	6.98	.1	.98
.2	.10	.25	6.98	.2	.98
.5	.10	.5	6.98	.5	.98
.1	.10	.1	9.98	1	1.98
.2	.10	.25	9.98	2	2.98
.5	.10	.5	9.98	4	3.98
.1	.10	.1	12.98	440vac	1200vdc
.2	.10	.25	12.98	.1	1.29
.5	.10	.5	12.98	.15	1.29
.1	.10	.1	19.98	440vac	600vdc
.2	.10	.25	19.98	1	2.98
.5	.10	.5	19.98	2	3.98
.1	.10	.1	29.98	440vac	1800vdc
.2	.10	.25	29.98	1	3.98
.5	.10	.5	29.98	2	4.98
.1	.10	.1	39.98	440vac	2500vdc
.2	.10	.25	39.98	1	4.98
.5	.10	.5	39.98	2	6.98
.1	.10	.1	49.98	440vac	3000vdc
.2	.10	.25	49.98	1	5.98
.5	.10	.5	49.98	2	7.98
.1	.10	.1	59.98	440vac	4000vdc
.2	.10	.25	59.98	1	7.98
.5	.10	.5	59.98	2	9.98
.1	.10	.1	69.98	440vac	5000vdc
.2	.10	.25	69.98	1	9.98
.5	.10	.5	69.98	2	12.98
.1	.10	.1	79.98	440vac	6000vdc
.2	.10	.25	79.98	1	12.98
.5	.10	.5	79.98	2	16.98
.1	.10	.1	89.98	440vac	7500vdc
.2	.10	.25	89.98	1	14.98
.5	.10	.5	89.98	2	19.98
.1	.10	.1	99.98	440vac	10000vdc
.2	.10	.25	99.98	1	19.98
.5	.10	.5	99.98	2	24.98
.1	.10	.1	109.98	440vac	12500vdc
.2	.10	.25	109.98	1	24.98
.5	.10	.5	109.98	2	29.98
.1	.10	.1	119.98	440vac	15000vdc
.2	.10	.25	119.98	1	29.98
.5	.10	.5	119.98	2	34.98
.1	.10	.1	129.98	440vac	20000vdc
.2	.10	.25	129.98	1	34.98
.5	.10	.5	129.98	2	39.98
.1	.10	.1	139.98	440vac	25000vdc
.2	.10	.25	139.98	1	39.98
.5	.10	.5	139.98	2	44.98
.1	.10	.1	149.98	440vac	30000vdc
.2	.10	.25	149.98	1	44.98
.5	.10	.5	149.98	2	49.98
.1	.10	.1	159.98	440vac	40000vdc
.2	.10	.25	159.98	1	49.98
.5	.10	.5	159.98	2	54.98
.1	.10	.1	169.98	440vac	50000vdc
.2	.10	.25	169.98	1	54.98
.5	.10	.5	169.98	2	59.98
.1	.10	.1	179.98	440vac	60000vdc
.2	.10	.25	179.98	1	59.98
.5	.10	.5	179.98	2	64.98
.1	.10	.1	189.98	440vac	70000vdc
.2	.10	.25	189.98	1	64.98
.5	.10	.5	189.98	2	69.98
.1	.10	.1	199.98	440vac	80000vdc
.2	.10	.25	199.98	1	69.98
.5	.10	.5	199.98	2	74.98
.1	.10	.1	209.98	440vac	90000vdc
.2	.10	.25	209.98	1	74.98
.5	.10	.5	209.98	2	79.98
.1	.10	.1	219.98	440vac	100000vdc
.2	.10	.25	219.98	1	79.98
.5	.10	.5	219.98	2	84.98
.1	.10	.1	229.98	440vac	110000vdc
.2	.10	.25	229.98	1	84.98
.5	.10	.5	229.98	2	89.98
.1	.10	.1	239.98	440vac	120000vdc
.2	.10	.25	239.98	1	89.98
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C	13/16	1/4	2.98
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SUPER-Wide-Range HiFi TRIODE LOW WATT. 10to20000 cycles, 6B4G's, Max Harmonic Distortion 1¾% at full output, 1% only ¼% at 5W output. Includes Bass & Treble tube boost & Tone ckts 4PreAmp G.E. pickup 5 dual & 2 output (7) tubes. Parts, RCA chassis & info., less output xformer **$29.95**
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0-150V, Weston, 3" sq., Rect. Type	8.98
0-800 Volts DC Weston 3" sq. Built in multiplier	12.98

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"TAB" TESTED & GUARANTEED
PRICES SUBJECT TO CHANGE

0A2	$1.29	12J2T	10.69	6AQ7GT	1.19	5516	5.98	2050	1.19
0A3/VR75	1.42	12J2TA	9.25	6AR5	1.79	5517	5.98	2051	1.79
0A4G	1.45	2J27	7.90	6AR6	2.98	5594	5.85	8A340	10.00
0B2	1.65	2J31	29.75	6AS5	.79	5608A	5.98	8D21	1.79
0B3/VR90	1.23	2J31A	79.95	6AS6	2.79	5651	3.05	5BP1	4.98
0C3/VR105	1.43	2J32	79.95	6AT6	1.49	5654	4.72	5BP4	4.98
0D3/VR150	.98	2J33	39.39	6AT6	.82	5654	4.72	5BP4	4.75
0Y4	2.53	2J34	18.50	6AU6GT	1.49	5656	19.98	5CP1	4.95
0Z4	.79	2J36	120.00	6AV5	1.98	5663	5.98	5CP1	4.95
1A5	12.49	2J37	12.70	6AV5GT	1.29	5670	6.98	5CP7A	9.98
1A7GT	1.79	2J38	12.70	6B4G	1.79	5671	6.98	5CP7A	9.75
1A6	.69	2J39	49.50	6AW6	1.69	5682	7.69	5NP4	9.75
1A6GT	1.79	2J40	49.50	6B4G	1.79	5686	4.23	5FP14	24.50
1A6P	.69	2J42	29.50	6B6G	1.78	5686	4.23	5FP14	18.98
1A6PT	1.79	2J48	29.50	6B8	1.79	5687	4.23	5JP1	29.95
1A6QT	1.79	2J49	29.50	6B8G	.89	5687	4.23	5LP1	29.95
1A6T	1.49	2J50	27.50	6B8G	.89	5691	3.98	5NP1	9.75
1A7GT	1.19	2J51	249.50	6B8T	1.19	5726	3.89	5NP1	9.85
1AE4	1.80	2J52	249.50	6B8G	1.09	5734/CK6125	5.98	5NP1	9.85
1B3 8016	.98	2J53	49.50	6BA6	.79	5750	6.49	7BP1	4.95
1B4P	2.98	2K25	31.50	6BA7	.89	5749	6.49	7BP1	4.95
1B5 25S	.99	2K25/		6BC5	.69	5751	5.45	7JP1	18.39
1B7GT	1.79	723AB	29.45	6BE6	1.09	5762	5.98	7LP1	18.39
1B21/471A	2.85	2K28	23.95	6BD5GT	1.69	5812	2.98	9LP7	10.95
1B23	9.90	2K29	23.95	6BD6	.79	5814	5.49	10BP4	24.50
1B24	9.90	2W30T	.98	6BE6	.79	5814	5.49	10FP4	24.50
1B26	17.49	2X2	.69	6BF5	1.06	5933	4.49	12DP4	49.50
1B27	24.00	3A4	.99	6BG6G	2.55	6A6300	4.49	12DP7A	49.50
1B27	24.00	3A5	.99	6BH6	2.55	6002R	.99	50	12DP1	49.98
1B37/ 532A	10.00	3A8	1.69	6BK7A	1.79	6003	1.98	50	12HP1	49.98
1B39	11.98	3A8GT	1.59	6BK7	1.98	6008	6.40	12MP7	16.89
1B40	10.98	3B4	2.29	6BL6	1.98	6012	2.89	12MP4	16.89
1B35	29.95	3B5	.89	6BM6	.79	6012	2.89	12KP4	47.00
1B40	4.95	3B7/1291	.69	6BN7	2.15	6013A	6.45	905	3.49
1B41	18.00	3B24	4.95	6BQ7GT	1.29	6014	2.98	913	3.49
1B42	18.00	3B28	4.95	6BN6	1.49	6020	1.25	915	3.49
1B43	49.95	3B29	4.50	6BQ6GT	1.29	6021	1.25	914A	15.00
1B44	49.95	3B32	4.50	6BG6GT	1.29	6030	1.95		
1B45	38.50	3B35	4.50	6BG6G	2.29	6061	1.85	Vacuum Capacitors	
1B58	350.00	3B38	8.50	6BY5G	1.45	6062	1.98		
1B59	9.75	3B/XXB	4.49	6C4	.79	6063	1.98	MMF	5KV	Each
ELIC	2.70	3C22	125.00	6C5GT	.79	6064	1.98	25	5	3.49
1C5GT	.89	3C23	10.98	6C6	.78	6065	1.98	50	5	3.98
1C6	.89	3C24/C1B	3.98	6C8G	.79	Sub-Miniatures		100	5	4.98
1C7G	.89	3C31	14.98	6C10	1.29	5/8		50	20	9.98
1C9GP	.89	3C45	14.98	6C21	2.98	1A3	5.95	100	20	9.98
1D7G	.89	3C/4X	5.49	6C24	.89	1A4	4.75	25	30	9.98
1D8GT	.89	3C45	14.98	6C33	2.98	1A5	4.75	50	30	10.98
1E5	.89	3C/4X150A	5.49	6C40	2.98	1A6	3.98	25	32	14.98
1E7G	.89	3D22	4.90	6D4	.79	2E41	1.49	50	32	14.98
1F4	.89	3D23	4.90	6D6	1.49	2E43	1.39	150	20	14.98
1F5G	.79	3L64	1.29	6D8GT	.89	2E45	1.49	150	30	14.98
1F6	.89	3Q4	.79	6E5	.79	2E46	1.49	25	32	14.98
1F7G	.89	3Q5GT	1.29	6E7	1.39	CK501AX	1.26	25	32	14.98
1G4GT	.89	3S4	.89	6F4	1.79	CK502AX	1.26	Tuner Bases		
1G5G	.89	3V4	.79	6F5	.79	CK502AX	1.79	10x897		3.49
1F7G	.89	4-125A	29.95	6F6	.89	CK504AX	1.79	20x577		2.98
1H4GT	.89	4-250A	62.50	6F6GT	.89	CK505AX	1.79	20x1552		2.98
1H5G	.89	4-1000A	168.50	6F7	.79	CK506AX	1.79	21x552B		4.29
1H6G	.89	4B27	4.95	6F8G	.79	CK507AX	1.79	21x552		4.29
1J5G	1.20	4C25/		6G6G	1.19	CK512AX	1.79	2117201		9.75
1J6GT	.79	RK54	5.98	6H6	.49	CK513AX	1.79	2117202		9.75
1L4	.89	4C33	89.00	6H6GT	.49	CK525AX	1.79	659481		2.98
1L6	.89	4C35	13.98	6J4	2.98	CK526AX	1.79	Mazda Pilots		
1LA4	1.79	4C/257	14.98	6J5	.79	CK528AX	2.39	49	box 10	.80
1LA6	.99	4J22	148.50	6J5GT	.79	CK529AX	2.98	51	box 10	.80
1LB4	1.98	4J23	148.50	6J6	.79	CK530AX	2.98	55	box 10	.80
1LC5	.79	4J34	194.00	6J7	.79	CK531DX	1.98	64	each	.07
1LC6	.79	4J/7609	17.50	6J7GT	.79	CK534AX	1.98	76	2AW	.18
1LD5	.89	4J47	280.00	6K6	.79	CK534AX	1.98	89	100W 20V	.25
1LE3	.89	4J/5764	158.50	6K6GT	.79	CK536AX	1.98	90	box 10	.36
1LH4	.89	4J52	350.00	6K7GT	.79	CK537AX	4.98	311	28V	.15
1LN5	.79	4T4 /2	5.95	6K8	.89	CK538DX	1.98	313	28V	.15
1P5GT	.79	4X150A	45.00	6K8G	.89	CK539DX	1.98	313	28V	.15
1P5GT	.79	4X-500F	85.00	6L5G	.79	CK541DX	1.98	Xtal Diodes		
1P21	4.75	4X-500A		6L6	.89	CK542DX	1.98	Many Late Dates		
1P22	4.75	4T4 /2	5.95	6K7	.89	CK543DX	.98	Latest JAN Specs		
1P24G	.89	4X150A	45.00	6L6G	.89	CK544DX	.98	1N21		1.25
1P5GT	.79	4X-500F	85.00	6L6GA	.89	CK546DX	1.98	1N21A		1.65
1P22	4.75	4X-500A		6L6GB	.89	CK547DX	1.98	1N21B		1.65
1P24G	.89	5AR4/GZ34	1.35	6L6G	.89	CK548DX	1.98	1N21C		27.45
1P24G	.89	5AU4/GZ34	1.35	6L6GC	.89	CK549DX	.98	1N22		1.25
1R4/1294	1.29	5D21	24.50	6L6GT	.89	CK550DX	1.98	1N23		1.65
1R5	.79	5D21/WK65		6L7	1.29	CK551DX	1.98	1N23A		2.98
1S4	.79		24.95	6S5	.89	CK552DX	1.98	1N23B		2.98
1S5	.79	5J29	12.49	6S7G	.89	CK553DX	1.98	1N23C		3.98
1T4/	.79	5J29 Spec.	9.98	6SA7	1.39	CK554DX	1.98	1N24		7.45
1T4T	.79	5R4WGY	2.98	6SF5GT	.89	CK555DX	1.98	1N25		7.45
1T4GT	.79	5U4G	.77	6SH7	.89	CK556DX	1.98	1N26		24.00
1U4/5910	.89	5U4G	.77	6SJ7	.89	CK557DX	1.98	1N32		2.98
1U5	.79	5V4G	1.39	6SK7	.89	CK558DX	1.98	1N34		1.98
1V	.79	5Y3	.89	6SL7GT	.89	CK559DX	1.98	1N34A		.98
1V2	.79	5X4G	.79	6ST7G	.89	CK560DX	1.98	1N35		1.65
1V2	.79	5Y3G	.79	6SN7GT	.89	CK561DX	1.98	1N36		1.65
1V2	6.98	5Y3G	.79	6SA7GT	.89	CK562DX	1.98	1N37		1.65
2A3	1.79	5Z3	1.29	6SC7GT	.89	CK563DX	1.98	1N38		1.65
2A3	1.79	5Z4	1.29	6SD7GT	.89	CK564DX	1.98	1N39		1.65
2A5	.89	6A3	1.59	6SF5GT	.89	CK565DX	1.98	1N40		1.65
2A6	.89	6A4	1.59	6SF7	.89	CK566DX	1.98	1N41		1.65
2A7	.89	6A5	1.59	6SH7	.89	CK567DX	1.98	1N42		1.65
2AC/5	4.98	6A6	.89	6SJ7	.89	CK568DX	1.98	1N43		1.65
2AC15	4.98	6A7	.89	6SK7	.89	CK569DX	1.98	1N44		1.65
2B7	.89	6A8GT	1.09	6SQ7	.89	CK570DX	1.98	1N45		1.65
2B22	3.49	6AB4	.89	6T8	.89	CK571DX	1.98	1N46		1.65
2C21/1642	3.37	6AC5/6N5	1.33	6SL7GT	.89	CK572DX	1.98	1N47		9.00
2C22/7193	.33	6AC7/1853	1.39	6SN7GT	.89	CK573DX	1.98	1N48		.79
2C26	2.28	6AC7W	1.39	6SQ7GT	.89	CK574DX	1.98	1N51		1.65
2C26A	.47	6AC6G	1.49	6SQ7GT	.89	CK575DX	1.98	1N52		1.65
2C34		6AD6G	.89	6SR7	.89	C'Ray Tubes		1N53		1.65
RK233A	3.49	6AD6G	.89	6SS7	.89	3BP1	.98	1N54		1.65
2C34/RK34	4.98	6AE5GT	.89	6ST7	.89	3CP1	7.90	1N55		1.65
2C39	32.50	6AF6G	1.33	6SU7GTY	3.37	3AP1	14.95	1N56		1.65
2C40	19.90	6AG5	1.29	6T8	.89	3BP1	7.95	1N57		1.65
2C40 JAN	19.90	6AG7	1.99	6T8G	1.29	3CP1	14.98	1N58		1.65
2C43	26.75	6AH5G	1.49	6T8	1.29	3EP1	4.98	1N59		1.65
2C43 /464A	9.45	6AJ5	1.29	6U4 /6AX4	1.29	3FP1	4.98	1N60		1.65
2C44	1.20	6AJ5	2.16	6U5 /6G5	.99	3GP1	4.98	1N61		1.98
2C51	2.98	6AK5	1.29	6U7G	.89	3HP1	4.98	1N62		
2C52	8.98	6AK5W	2.98	6U7G	.89	3JP1	14.98	1N63		2.49
2C53	1.98	6AL5	.69	6V6	.89	3JP12	10.93	1N64		1.98
2E5	1.19	6AL5	.69	6V6GT	.89	3JP14	16.98	1N65		1.98
2E24	1.49	6AL7GT	1.29	6W6	1.29	3KP14	14.98	1N69		1.98
2E25	4.25	6AM5	1.29	6W6GT	.89	4AP10	34.98	R34		1.98
2E25/HY69	6.15	6AQ5	.89	6W6GT	.89					
2E26	3.49	6AQ5W	1.29	6X4	.89					
2E30	2.19	6AQ6	1.25	6X4	.89					

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12AQ5	1.29	35L6GT	.89	FG95	9.75	7R75	13.75	931A	6.98
12AT7	1.49	HY31Z	2.75	100TH	8.89	WL575	10.49	954	.29
12AU6	.79	35W4	.89	100TL	8.89	WL579B	12.98	955	.29
12AU7	.95	FG32/		1020	2.98	801B	.19	956	.39
12AV6	.79	5516	13.95	1613	1.49	HY615	.98	957	.39
12AW6	1.79	32L7GT	1.49	FG105	18.98	616	37.00	958A	.67
12AX4GT	1.79	35Z3	1.45	FG105	1.45	HU627	18.00	991	.39
12AT6	.79	35Z4GT	.89	HY1140	.75	7R870A	14.95	1000	1.98
12AY7	2.95	35/51	.98	HY115/		701A	5.89	CK1005	.85
12AZ7	1.79	36	.79	1176	.79	702A	5.89	CK1006	.85
12BA7	.79	350B	.79	1171/		702B	5.98	CK1007	.85
12BE6	.79	35L6GT	.89	HY1177	1.59	703A	5.98	CK5702	2.98
12BE6	.89	35Z5GT	.89	HY1178	1.79	704A	.98	CK5703	5.00
12BH7	1.29	35TG	3.45	1173	.98	705A		CK5704	12.00
12BH7	1.29	35W4	.89	1174GT	1.39	707A	10.49	HY1312Z	5.
12BY7	1.29	35Y4	.89	1175GT	1.49	707B	17.49	1613/	
12C8	1.98	35Z3	.89	1177GT	1.49	710A/		1613	1.98
12CU6	.79	35Z5GT	.89	1178GT	1.49	8011	.95	FG6X	.98
12H6	.89	35Z5GT	.89	T125	12.49	713A	1.00	1616	.90
12J5GT	.89	36LX6/6J6	.89	T125A	15.98	714AY	8.90	1619	2.29
12J7GT	.89	36	.89	YY1127A	3.90	714AY	8.90	1620	5.75
12K7GT	.89	37	.89	YY1128	3.90	715A	6.45	1622	2.69
12K8	.98	38	.89	150T	14.50	715B	6.45	1623	2.69
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12SC7	.89	41	.89	201A	4.25	718CY	48.45	1630	.35
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12SH7	1.10	41	.79	A301A	.98	723	2.45	1635	.73
12SJ7GT	.89	42	.79	203A	5.98	723A	5.49	1636	1.49
12SK7	.89	43	.85	205B/VT2	1.69	723A/B	14.49	1636	3.15
12SL7GT	.89	45	.89	CK205	3.15	724A	3.49	2000T	149.50
12SN7GT	.89	45Z5/VT52	.34	211/VT4C	1.89	724B	3.45	2000T	149.50

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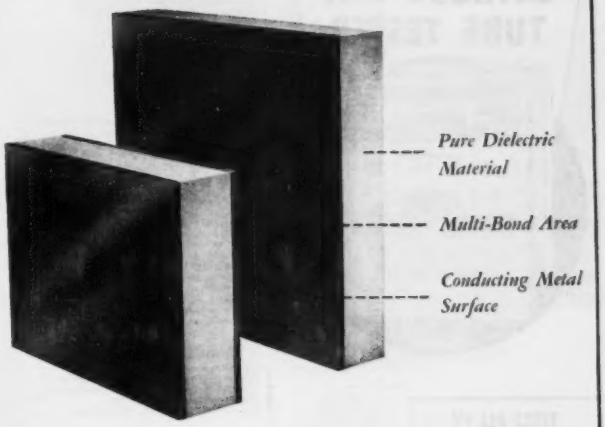
CHEMELEC MULTI-BOND



Metal Faced TEFLON*

● Here is the answer to the bonding and hermetic sealing of dielectric materials to metal components.

Chemelec Multi-Bond is metal faced pure or filled TEFLON, produced by an exclusive (patents pending) method of uniting fluorocarbon resins and metals with an interlocking bond unaffected by severe mechanical shock, vibration and unequal rates of thermal expansion.

The bond is micro-crystalline in structure and gradually changes from dielectric to metal, the conducting metal surface being applied by electro-deposition or other conventional means.

Facing metals include practically all the ferrous and non-ferrous metals, the ferro magnetic group and the precious metals.

Sheets are available, metal faced on one or both sides, in thickness from .034 to 1.75 in. and in sizes up to 36 in. square.

Write for Bulletin MI-424.

**du Pont's trademark for its tetrafluoroethylene resin.*

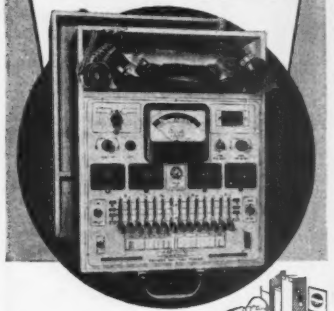
UNITED STATES GASKET COMPANY

FLUOROCARBON PRODUCTS DIVISION

600 N. 10TH STREET, CAMDEN, N.J.

FOREMOST FABRICATORS OF "TEFLON" AND OTHER FLUOROCARBON PLASTICS

THE NEW
"PRECISION" CR-30
CATHODE RAY
TUBE TESTER



TESTS ALL TV PICTURE TUBES
(Magnetic and Electrostatic)
'SCOPE TUBES AND INDUSTRIAL CR TYPES

IN FIELD, LAB & WAREHOUSE
Tests CR Tubes without removal from chassis or carton!

A complete and self-contained Electronic Instrument. Incorporates a TRUE BEAM CURRENT Test Circuit. Checks overall electron-gun performance for proportionate picture brightness. Additional tests for accelerating anodes and deflection plate elements.

The Precision CR-30 should not be confused with mere adapters connecting to ordinary receiving tube testers which were never designed to meet the very specialized needs of CR tube checking. Similarly, it is not to be confused with neon-lamp units or similar devices of limited technical merit and which do not check all CR tubes or all tube elements.

GENERAL AND TECHNICAL SPECIFICATIONS

★ **Tests All Modern Cathode Ray Tubes. Tests All CR Tube Elements:** Not just a limited few.

★ **Free-Point 14 Lever Element Selection System,** independent of multiple base pin and floating element terminations, for Short, Leakage and Quality Tests.

★ **True Beam Current Test Circuit** checks all CR Tubes with Electron-gun in operation. It is the **Electron Beam** (and NOT total cathode emission) which traces the pattern on the face of the CR tube. The significance of the above rests in the fact that Beam Current (and picture brightness) is primarily associated with the condition of the **center** of the cathode surface and not the overall cathode area.

★ **Voltage Regulated, Bridge Type VTVM** affords supersensitive tube quality indications and positive check of low current anodes and deflection plates.

★ **Micro-Line Voltage Adjustment Meter-monitored** at filament supply.

★ **Accuracy** of test circuits closely maintained by use of factory adjusted internal calibrating controls; plastic insulated, telephone type cabled wiring; highest quality, conservatively rated components.

★ **Built In, High Speed, Roller Tube Chart.**

★ **Test Circuits** Transformer Isolated from Power Line.

★ **4¼" Full Vision Meter** with scale-plate especially designed for CR tube testing requirements.

★ ★ ★

SERIES CR-30—In hardwood, tapered portable case. 17¼" x 13¾" x 6¾". Complete with standard 12 pin tube cable and universal CR Tube Test Cable.

Shipping Weight: 22 lbs.....Net Price: $99.75

See the new CR-30 on display at leading electronic equipment distributors. Place your orders now to assure earliest possible delivery.

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ELMHURST 10, N. Y.

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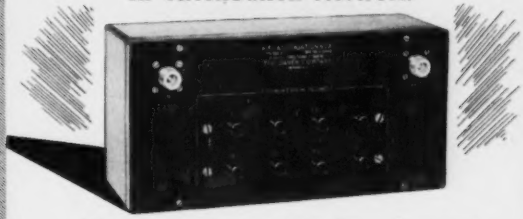
You Can Depend on DAVEN for *Accuracy* in Attenuators

For many years Daven has beeen known for the quality of its attenuators. And, although Daven production has grown to include a wide variety of instruments for the electronics industry, the development of its attenuators has grown apace. Much of the testing equipment used by Daven to guide them in the manufacturing of attenuators has been developed by Daven's own engineering specialists. As a result, Daven attenuators have become the standard of the industry, by which all other similar equipment is measured. Shown and described here are two of the newest units that are typical of the vast Daven line of attenuators. Your inquiry for specific information to apply to your own particular problems is invited. Let Daven furnish you with completely detailed catalog data.

THE DAVEN CO.
191 CENTRAL AVENUE
NEWARK 4, N. J.

RF Attenuation Network

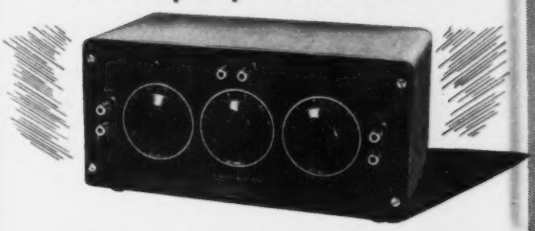


This equipment is an exclusive Daven development. It is a moderately priced attenuator incorporated in an RF Attenuation Box to insert accurate losses from D.C. to 225 MC. The unit has many applications where attenuation of UHF is desired, since it can be utilized as an all-purpose laboratory and test instrument.

SPECIFICATIONS

ZERO INSERTION LOSS OVER ENTIRE FREQUENCY RANGE.
FREQUENCY RANGE: Zero to 225 MC.
IMPEDANCE ACCURACY: Within ±5% over frequency range.
ATTENUATION ACCURACY: ±5% over frequency range.
CONNECTORS: Receptacles are supplied. Cable plugs, if required, will be supplied at a slight additional cost. When ordering, specify which type connector is desired—either Series "BNC" (UG-185/U) or Series "N" (UG-58/U).
CIRCUIT: Constant input and output impedance (unbalanced). Zero initial loss.
RESISTOR ACCURACY: ±2% at D.C.

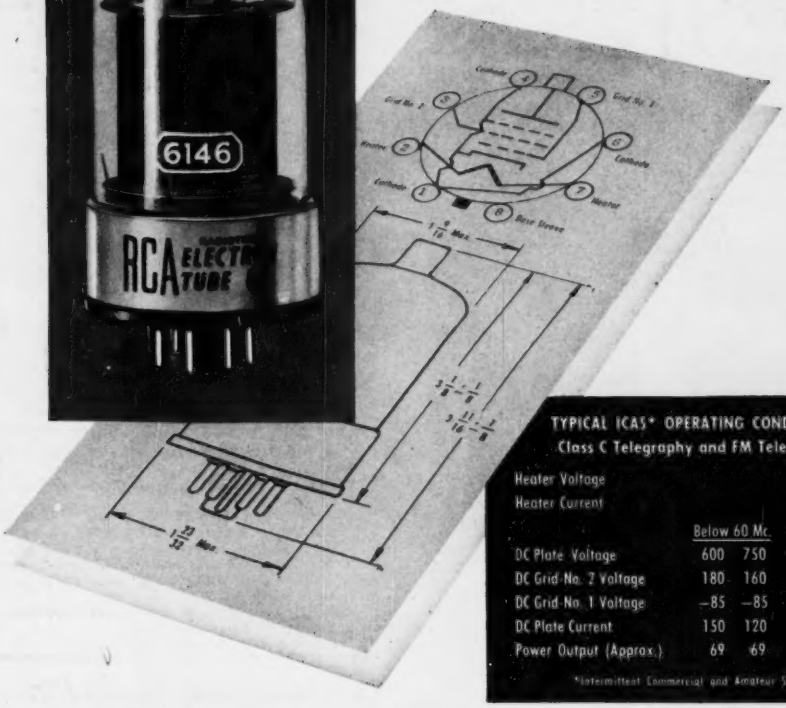
Carrier Frequency Decade Attenuator



This equipment is particularly applicable to extremely accurate measurements from D.C. to 200 kc. and can be used up to the lower radio frequencies. The Decade type switches make the box convenient to use. In addition, there are switch stops which prevent return from full to zero attenuation when making adjustments. A total of 110 Db. is available in 1.0 Db. steps, or 111 Db. is available in 0.1 Db. steps. Both of these types may be obtained in either a balanced H or an unbalanced T network.

SPECIFICATIONS

ACCURACY: Each individual resistor is adjusted within ±0.25% of its correct value. The error in attenuation is less than ±1% of the indicated value, provided the output is matched by a pure resistance.
FREQUENCY ERROR: At frequencies below 200 kc., the total error in attenuation will not be greater than ±1% of the indicated value.



TYPICAL ICAS* OPERATING CONDITIONS
Class C Telegraphy and FM Telephony

Heater Voltage			6.3 volts
Heater Current			1.25 amps
	Below 60 Mc.		At 175 Mc.
DC Plate Voltage	600	750	400 volts
DC Grid-No. 2 Voltage	180	160	200 volts
DC Grid-No. 1 Voltage	−85	−85	−54 volts
DC Plate Current	150	120	150 ma
Power Output (Approx.)	69	69	35 watts

*Intermittent Commercial and Amateur Service.

Another RCA First...the RCA-6146

New beam power tube for VHF transmitters

Specifically designed for VHF transmitter applications, the new RCA-6146 features low cost, small size, unusual ruggedness, and high power sensitivity. It can deliver an output of 35 watts at 175 Mc under ICAS conditions, with a plate voltage of 400V, and a plate current of 150 ma. Adequate driving power can be obtained from a 5763, 2E26, or another 6146, depending upon the circuit design requirements.

The RCA-6146 employs a rugged button-stem construction with short internal leads, and an octal base with short metal sleeve which shields the input to the tube so completely that no other external shielding is required. Input and output circuits are well separated by bringing the plate lead out at the top of the bulb. Base pin connections permit three connections to the cathode, to provide good rf grounding.

For complete technical data on the RCA-6146 and RCA-6159, write RCA, Commercial Engineering, Section 42AR, Harrison, N. J., or your nearest RCA field office.

FIELD OFFICES: (East) Humboldt 5-3900, 415 S. 5th St., Harrison, N. J. (Midwest) Whitehall 4-2900, 589 E. Illinois St., Chicago, Ill. (West) Madison 9-3671, 420 S. San Pedro St., Los Angeles, Calif.

Another **new RCA tube**

The RCA 6159, identical with the 6146 except for its heater rating of 26.5 volts, 0.3 amperes, is designed for VHF service in aircraft application.

The Fountainhead of Modern Tube Development is RCA

RADIO CORPORATION of AMERICA
ELECTRON TUBES **HARRISON, N. J.**